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HEALTH EDUCATION IN INDUSTRY

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Medical Director, General Chemical Company, New York City.

Read before Sociological and Industrial Hygiene Sections, American Public Health Association, at San Francisco, Cal., September 14, 1920.

The industrial health department can be made the strong right arm of the public health department. A part-time physician no longer suffices for a plant. He should be a full-time man with special training. If industry can pay $2.50 per employee per year for health, the community ought to increase its health appropriations.

TO SECURE the attention of a group of people is not dependent upon any definite predetermined formula. This is true whether the group be that of a municipality or any political unit or the members of an industrial organization. At least as many factors enter into the problem of health publicity as there are social elements in the community and each must be met with special consideration. If progress is obtained, the peculiarities, personal and communal, racial and religious, must be recognized or anticipated and treated individually with mass considerations. Notwithstanding the necessity of these implied qualifications on the part of the health administrator the most successful endeavors seem to have been made so by fortuitous circumstances, or by effort in the dierction of least resistance.

In the early history of medical service in industry the employment of a physician was considered an evidence of a benevolent attitude on the part of the employer. The protection secured against excessive costs resulting from accident and injury, the shortening of the period of disability, the relation of the doctor to relief agencies and recognition of the doctor's potential value as an intermediary in industrial relations established the plant physician, more or less, as a member of the operating staff. As a result of meritorious work on the part of a few pioneers in the field, it became evident that pre-employment examinations, as well as periodic re-examina-

tions, prolonged the usefulness of the employed to the industry, to the individual, to his family, and therefore to society, and has also resulted in the accumulation of facts that will clear up the hazy notions with respect to the hazards of certain occupations.

Probably the greatest opportunity for the promotion of the public health has arisen through the rapid development in industry of medical departments, manned as these departments should be by medical men giving their full time and thought to the conservation of human lives.

The doctor or industrial surgeon and the industrial nurse are the agencies through whom educational measures must reach the people. Good and effective as they have been, there is considerable to be said in criticism of both. Such critical intimation as I shall make will be directed toward the doctor, as I believe that the nurse is and should remain an adjunct to the medical man's service, rather than to assume independence of action—at least in this field.

In the discussion of our subject, a review of the relationship of the public health department, of the medical profession and of the public would seem, perhaps, profitable:

Public health is a field which embraces sociology, engineering, chemistry and bacteriology, as well as medicine, and the man with administrative gifts may have qualified for his post through any one of these allied sciences. The fact of being a competent physician does not make him a qualified health officer. Public health is a science and an art in itself and peculiar to itself, the essential being that the administrator shall have studied and practiced this science and art. If he be medically trained, his position, with the present professional viewpoint, is strengthened with his profession and the public.

As Drake has well stated, a health department in performing the functions imposed upon it by law, must reach, more or less directly, every person within its jurisdiction. The past generation has witnessed radical changes in the theory of preventive medicine. Officials are no longer permitted merely to meet emergencies as they arise. Health promotion has become more important than disease prevention, and disease prevention has come to be more regarded than disease suppression. The archaic policy of acting only in the development of emergency, and of merely being ready to make the best of a bad situation in repairing damage after it has occurred, has been relegated to a less enlightened day. In carrying out its work of prevention, a health department must endeavor to arouse the interest and attention of individuals rather than of the masses or classes.

An aggressive health department employs every possible means of publicity—the public press, as well as the other agencies of which I shall speak later—in an effort to maintain a personal contact. Unfortunately public health publicity costs money and, to be obtained, must be paid for. The controllers of the public purse have not yet arisen to the importance of this function and the endeavor has failed, excepting in the few instances in which private funds are available for the promotion and support of publicity. The success or failure of any movement for the betterment of publich health depends, to a great extent, upon the attitude of the medical profession. In the main, that attitude is sympathetic and encouraging. However, there have been measures of very decided public value involving principles of social and economic worth that have been so strongly opposed that their value has been lost to the community. The canons of the medical profession provide that the first duty of the physician is to the individual, whereas in preventable diseases, the first duty is to the public.

In the volumes of biologic essays pre-

pared by Sir William Osler's fellow-physicians to celebrate his 70th birthday, which lamentably appear rather as a memorial, the New British Ambassador presents certain reflections upon the medical profession which are as stimulating and suggestive as they are courteously phrased. More than any other of the great professions, Sir Auckland Geddes says, physicians lack "the spirit of citizenship," the willingness "to bear their share of the burden of the Government." Their devotion to science and to the service of individual healing is paramount; they do not conceive of these things in their relation to the nation. "I have heard teachers in medical schools say that their whole duty to their students was to teach them to prevent disease, to treat the sick and to understand the method of science." Sir Auckland Geddes denies this, though to do so "seems to me, in my purely scientific moods, almost discreditable."

The forces which determine national progress, and with which a statesman is primarily obliged to grapple, are not recognized in any science to which the physician is trained. They are the forces of "mass emotion," largely blind, inarticulate and groping, yet supreme and indomitable, forces of the racial genius. Just at present these are forces with which the physician, if he could only recognize the fact, is peculiarly qualified to deal, "an emotion of human betterment, finding expression in centers for child welfare, in schemes for housing the working classes, in the establishment of ministries of health, of reconstruction and research." In brief, "we are at this moment in the power of a worldwide emotional storm, the full effects of which are not yet manifest," but which will center in the betterment of the nation's health and of the more purely human relationships. Meantime the medical profession, "with brilliant exceptions," is composed of men who are "immature as citizens" and whose citizenship, such as it is, "is as divorced from their technical knowledge as is the citizenship of the speculative builder when he jerry-builds new slums." The world is "moving on to the greatest of its revolutions," but the majority of physicians, "who might be its far-seeing leaders," are "blind and babbling of industrial unrest."

Throughout a relatively brief but active relation with the medical profession it has been observed that the individual doctor has been so occupied with the specific case that he has all too frequently permitted others to direct the social, economic and professional adjustments that modern progress has made necessary—this, notwithstanding that the professional interests and those of the public are identical and should be solved and applied only by a socially-minded medical leadership. The present day is intolerant of isolation from affairs. With others, the doctor must become active and not only support and direct actively but create those remedies for the ills of society with which he is or should be familiar. Unless medicine does this and makes apparent its group strength before the people, the people will all too frequently be victimized by the various cults and pseudo-medical interests that quickly grasp the importance of public control and especially with legislative and governmental interests.

Science has developed facts that have afforded remarkable opportunity to progress, but, in so doing, serious obligations have been imposed upon the doctor. Changes in health administration have, at times, been radical, perhaps revolutionary, but no more radical and no more revolutionary than the changes that have come to our scientific thought. The modern health administration, in asking much, is likewise giving much to the physician. The individualization of health work, instead of threatening the material interest of the doctor, actually benefits him in many ways. The more intimately the individual doctor becomes

acquainted with the aims and purposes and underlying motives of a modern health department, the more valuable his influence becomes to the people of his community and the more useful the department becomes to him in the pursuit of his practice.

Health officials are now urging periodic physical examinations for all persons as the means of detecting insidious organic diseases in their incipient and easily curable stages, and while the medical profession may be called upon at certain times to render service gratuitous or with small direct return in such examinations for the purpose of education and demonstration, it is true that the establishment of this excellent custom is not only likely to save or prolong the lives of thousands but in the ultimate brings largely increased returns to the physician. The more that people think health and talk health, the more generally they seek medical counsel and guidance, consequently the more generally the physician is employed. It is invariably true, whenever there are established anti-tuberculosis leagues, with their dispensaries, medical nursing service, together with the educational and publicity campaigns essential to their success, those medical men specializing in tuberculosis, as well as the general practitioner, have an increased clientele among those actually suffering from tuberculosis and seeking treatment for it, as well as those who come to think seriously of their own physical condition on account of the agitation of the subject. This is similarly true in communities in which campaigns against venereal diseases have been undertaken. In such communities the venereal specialists and general practitioners report an increased demand for this service and, of course, this means that the uninformed have not sought the advice of the advertising or itinerant quack. This well illustrates the fact that that which is best for the people of the community and that which may be over-insistently urged upon them, redound to the material advancement of the reputable physician.

The physical examination of school children with the discovery of the enormous number of defects of the upper air passages of the ears and mouth, heretofore regarded as relatively harmless, has conferred enormous physical benefit to the community as well as to the financial state of the medical man. This same helpful attitude is maintained by the diagnostic laboratory in its relation to the medical profession. While such laboratories are maintained for the benefit of the people as a whole, the service of the laboratory is rendered almost wholly through physicians. Occasional specimens are received from laymen but the name of the attending physician always accompanies the specimen, and a report sent to the physician, and in practically every instance it is found that such specimens are sent with the advice of the doctor. In the case of Wassermann tests, it is doubtful if the laboratory ever received a specimen, except from a physician. This is similarly true of specimens from patients suspected to be suffering from diphtheria, typhoid and the other communicable diseases. In actual practice the laboratory is maintained wholly for the convenience of the medical man, saving him hours of labor and no inconsiderable outlay of money. If one may judge by the increasing demand for laboratory service, this convenience is becoming generally appreciated. On the other hand, the more generally the members of the medical profession engage in modern health activities in their own community, the more quickly they utilize the service of the staff of the several divisions of the department, the more constantly they employ the services of the laboratory for the exact diagnoses, the greater assistance they are rendering the government in meeting its obligations to the people.

The closest possible relation should exist between the private or industrial

physician and the public health official. Public health departments heretofore have been limited in their relations with individuals for the purpose of teaching personal hygiene. The industrial health department can be made the new and strong arm of the public health department in bringing about precaution in matters of health. Morbidity statistics not now available may be secured, as well as organized assistance in times of epidemic.

The demand for this kind of service by the far-seeing executive, unappreciative of the necessary qualifications of a medical director capable of undertaking the responsibility, has led many medical men, the recent graduate, the unsuccessful or moderately so, into the field of industrial medicine; but until qualified men are created by university training or long and varied experience, the cause of industrial medicine and in turn of industry itself, will not obtain the largest measure of benefit. It no longer suffices for an industrial organization of any size to employ a part-time physician who utilizes his job to pay office rent or automobile upkeep. The physician who considers accident work or casualty surgery as a mere "pot boiler" over a period of financial stress will hardly prove ornamental to his profession.

To meet the present-day requirement of a medical director, service director, or however he may be characterized, it seems that the following qualifications are essential:

He should be a man of good general education, upright in bearing and demeanor, possessed of tact and judgment. He must have had a sound professional training in a college stressing the great basic foundations of his future work, namely, anatomy, physiology and pathology, a general hospital training of not less than two years with special attention to surgery.

He should have at least five years of general practice, in that a knowledge of man and his foibles may be acquired. During this period it is necessary that the future industrial physician should maintain a connection with the public health agencies, such as the city health department with its various dispensaries, the general dispensary, and other public medical service, in order to develop the social viewpoint as well as to broaden professional skill.

He should be capable of making elementary physical, psychological and psychopathical observations.

The industrial physician should have a knowledge, not necessarily profound, of the fundamentals of industrial relations; these are widely applicable and include applied preventive medicine, accident prevention and the methods leading thereto.

He should have knowledge of employment methods; some notion of job analysis; knowledge of race problems, knowledge of industrial training, apprenticeship, continuation schools for training in particular jobs.

He should have knowledge of the special problems relating to the employment of women and children; some knowledge of pensions and insurance, including liability, group and social; some knowledge of plant organization, which is likely to prove effective in dealing with the problems of labor.

He should have knowledge of the hours of work in relation to fatigue and output; knowledge of shift systems, rest periods, regularity, absenteeism, etc.

He should have at least a superficial knowledge of the security and continuity of employment in slack seasons, while convalescing from accident or disease, in case of labor-saving improvements, as well as with the advent of old age, the transfer and replacement of misfits, or as has been said "fitting the square peg to the round hole."

He should have a general knowledge of physical working conditions, safeguards, disagreeable gases and dusts; heating, lighting, ventilation, locker rooms,

wash rooms, rest rooms, restaurants, hospitals, laundries, toilets, showers, plant beautification, drinking water. Of course, he should be responsible for the physical examination of applicants and the periodic re-examination of employees, as well as the medical attention to families of employees when such is supplied.

He should have very definite knowledge of housing, transportation, recreational and educational facilities, and at least some knowledge in relation to the cost of living according to local standards.

He should be familiar with the follow-up work, especially among new employees and with the injured; the replacement of injured and crippled employees.

He should have at least some knowledge of the athletic and social activities, company stores, commissaries, the type of house suitable for economic administration and housing problems generally.

He should be familiar with labor trunover and its cost; designs and data for the construction and operation of hospitals, lunch rooms, neighborhood and community houses; general education and Americanization, together with a knowledge of broad methods of raising the standard of employees' living conditions and ideals.

And as Merideth has recently pointed out, it is time the doctor realized his concern in the human, normal as well as sick; that his ideal should be the human body always well—his shame, the human body sick. It must be realized that health, like disease, is a medical problem and that if we have a responsibility for the sick, our responsibility is nevertheless for the well. We, in industrial medicine, are seriously at fault in not devoting more attention to increasing knowledge of the conditions of health.

In the foregoing I have perhaps wandered far afield, with the object, however, of indicating that the medical man with a broad view and such knowledge, however general, will be of such great value to his organization and every person in it, as to command the highest respect, wield a constant influence, find his post seeking him, and incidentally fix his compensation.

That which has made America great in industry is her faculty of bringing together energies hitherto rambling and misdirected into a rounded, concrete whole with largely amplified production. The mainspring of production or success is individual action and not state action. Success is nothing more nor less than opportunity for the individual. The enlightened business man of today sees clearly that the measure of his success is almost directly in proportion to the degree of opportunity his operation creates for others. But of what value is opportunity, lacking its essential adjuvant —the individual in good health.

In the United States there are 1,500,000 people constantly sick with preventable diseases, and 8,000,000 men between the ages of 18 and 45 are physically or mentally subnormal. While most of us are born with good health, we have but a brief existence before we carry within us, or are exposed without, to an agency of destruction. From a recent report by Irving Fisher, we are informed that there are approximately 3,000,000 persons in the United States suffering from some form of sickness, of whom 1,100,000 are in the working or productive period of life, three-fourths being actual workers who must lose at least $700 per year which aggregates $550,000,000. The expense of medicine, medical attention, hospitals, extra food, etc., at least equals this amount. Thus we have a total cost of illness amounting to $1,100,000,000, at least one-half of which is preventable.

The sick man is a burden to the community, while the well men is an asset. Out of every hundred who are 25 years old today, 36 will be dead at 65, 53 dependent upon relatives and charity, 6 self-supporting and only 5 well off. It

has been shown that of families dependent upon charity 77% of the members were physically unfit.

A most effective method of reaching the employee and his family is through the house organ, which, if well edited, is a welcome visitor to the domestic circle of each employee. It is well, of course, that the printed column should be supplemented by presentations by the medical staff of the organization, who should reach groups of employees orally or directly, as opportunity may offer, by means of the stereopticon or the motion picture. It has been my practice in lecturing to groups of employees and their families to discuss industrial medicine in accordance with the following scheme, closing the course by discussing problems and hazards peculiar to our own industry.

Physical examinations, their immediate and remote value, are considered by likening the human body to some well-known machine or device in the plant and demonstrating the analogy between the worn-out and exhausted parts and the organs of the human body, emphasizing the vital importance of maintenance and repair. This method can be readily applied to such organs as the kidneys, lungs, liver, circulatory apparatus, etc. The acute and chronic infections, whether of industrial or general origin, and their importance are pointed out.

The subject of personal hygiene is simply presented, utilizing the diseases or defects that have come to recent attention in the plant as a basis for illustration.

The subject of sanitation is presented systematically by following the plan of organization of modern health departments and their various divisions; for instance, the department of sanitation. The discussion includes the nuisance; sewerage and sewage disposal; garbage, its collection and disposal; domestic animals, flies, mosquitoes, etc.; together with the importance of good housing and the effects of bad housing and lodging houses. The spot maps made by health departments indicating the highest tubercular rate, the highest communicable disease rates (excepting perhaps typhoid fever), the greatest juvenile deliquency, crime, drunkenness, and so on through the entire category of social ills, match exactly the spot maps indicating the greatest housing congestion.

Some years ago the Department of Health of Cleveland, through Miss Chadsey, made a study of two districts, one being in the old crowded section of the city and the other in an outlying section, Newburgh way, which is composed largely of employees of the steel mills. Rents were practically the same. In the first district in 1907 to 1914, there were 980 cases of tuberculosis recorded, 52 per 1,000 of population. In the second there were 450 cases, or 28 per 1,000 population. In the first district in 1912 there were 665 of communicable diseases, or 3 per 1,000. In the second, 286 cases, or 1.29 per 1,000 of population. From the foregoing, little computation is required to fix definitely in dollars and cents the higher value of life in the uncongested section.

It must be borne in mind that a house is not a mere place for shelter. It must provide that which will promote efficiency in labor and strength of character and citizenship. The house connotes the family; the family and not the individual is the unit of our civic structure. It should not be forgotten that any consideration of the employee that omits the family is largely wasted effort. It is now well recognized that in the modern factory, at least, the employee is in a better environment than in his own home. It seems the height of folly for industry to expend many times the per capita cost of health administration on the maintenance of healthful surroundings in the factory and permit the ostensible beneficiary to return to a home environment carrying the elements potent

with destruction to the individual worker, his children and posterity.

Under the head of communicable diseases, prevention, treatment and a simple discussion of antitoxins, vaccines, their manufacture and use, the length and importance of quarantine, etc., are considered. Venereal infections and their effects, heretofore shrouded in mystery and crime and not discussed with candor and intelligence, are discussed freely, as they have now come to be recognized as the most important of communicable diseases. This subject always enlists and holds the attention of an audience. It is amazing that the average individual knows so little or nothing of the remote effects of venereal infection.

Tuberculosis presents a wide and interesting field. Its relation to housing, over-crowding, food, hours of labor, fatigue, rest, sleep, etc., are pointed out.

In connection with child hygiene, in addition to the child itself, prenatal care, reference to obstetrics, obstetrical procedure and infant feeding are discussed. The value of the medical examination of children is emphasized. Industrial hygiene is intimately related to child hygiene, yet when children leave school and enter active life the health authorities lose sight of them. Industrial hygiene is an important feature in public health work and it is plainly the duty of some authority to supervise these young men and women during the early period of their industrial activity.

Under the heading of food and dairy inspection, the production, cooling, handling, shipping, storage and delivery of milk, together with the food value, the importance of bovine tuberculosis, the dangers of the insanitary market, and the handling of food in the home are referred to.

In connection with vital statistics, birth registration and its importance invariably attract attention.

The laboratory affords opportunity for simple discussion of culture taking and examination of diphtheria, typhoid, gonorrhea, syphilis, etc. These subjects always enlist the closest attention of an audience. A description of the examination of water and its importance is also interesting.

These and other health department activities, presented even with haste, hold the attention of an audience for half to three-quarters of an hour and bring forth questions indicating not a little grasp of the subjects discussed.

Supplementing the lectures, it is advisable to offer a motion picture show. Stereopticon and motion pictures appeal to shop employees and their families and large appreciative audiences are readily obtained either in the shop or at meetings under the management of employees associations which now exist among larger industries. Films are available from many sources. Our Government, in coöperation with other governments, together with educational and industrial institutions, maintains at Washington a Bureau of Commercial Economics, which has a large series of films on most of the subjects of personal and public welfare. The various state and municipal health departments and practically all of the state and national organizations for promoting health have series of pictures presenting strongly dramatic appeals on the subjects having their attention. The American Child Hygiene Association, the Social Hygiene Association, the National Tuberculosis Association, the American Medical Association, the National Housing Association, and others supply for a very modest cost sufficient material for a season of bi-weekly or monthly lectures.

A satisfactory series of lectures by the works' physician is difficult for the reason that most of our present-day industrial surgeons in small plants are part-time employees having neither the disposition, qualifications nor time to discuss community problems. Unfortunately again, the physician is trained to individualism, seeing only the case and not viewing disease in its community aspect.

His services are usually limited to advice to individual patients, and, if interested and conscientious, this service is, of course valuable and to him is due the highest credit for the discharge of this responsibility. The work is clearly desirable; but at what cost and how shall it be brought about?

In 1916, the National Industrial Conference Board surveyed 99 leading industries in an endeavor to ascertain the cost of health supervision in industry. It was disclosed that the cost incident to the care of 495,544 employees was $1.238,485, or $2.50 per capita. The budget of the New York Health Department is $3,957,202.15, or in round figures, $4,000,000. The population according to the Bureau of Census, July 1, 1918, is 5,872,143, or roundly, 6,000,000. Hence it is that the per capita expenditure is about 67 cents. The population of Cleveland in the same year was 810,-306 and its Health Department expenditure slightly less than $250,000, or somewhat over 30 cents per capita. This lack of expenditure does not include, however, the maintenance of hospitals. If industry sees its way clear to make an outlay of $2.50 per employee, surely it is possible for the community to make a somewhat larger output and obtain returns wholly out of proportion to the sum expended by industry and that from the public funds.

It is clear, therefore, that there is an overlapping of effort with no inconsiderable waste of money. Experience has shown that there are three stages to the development of social movements, or economic reforms; a period of agitation, a period of organization and a period of final incorporation of the desired orders of things. It is obviously the time for beginning an agitation having for its object the centralization of public health education and control in some centralized governmental authority. Industry is promoting the movement unconsciously, however. It is unfortunate that the present scope of the United States Public Health Service could not include the administration of compensation funds and other forms of social insurance likely to eventuate, which, in accord with the claims of their advocates will react to the prevention of disease.

It is perhaps more courageous than discreet to suggest that business in its present attitude toward government control, complete or partial, of social or economic function, pool its interest in a small group of the community with that of the community as a whole. Nevertheless, with the advantage demonstrated, executives are quick to respond to the demands of the period. It would seem entirely feasible to consolidate the function of compensation commissions and insurance boards to be created with that of national, state or municipal departments of health, or, if the principle of states' rights interferes, it would be workable to bring about coöperation between the agencies with the point of contact resting upon the state department, to the end that their respective functions be applied to a single or at least to correlated effort which would make its impress on the whole community in the better understanding of the purpose and value of preventive medicine.

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Are you thinking about the Fifteenth Annual Meeting of the A. P. H. A in New York City, November 14-18, 1921?

SOME ASPECTS OF POLLUTION AS AFFECTING OYSTER PROPAGATION

THURLOW C. NELSON, Ph.D.,
Assistant Professor of Zoology, Rutgers College,
Biologist New Jersey Board of Shellfisheries,
New Brunswick, N. J.

Read before the Laboratory Section, American Public Health Association, at San Francisco, Cal., September 18, 1920.

If present conditions continue, the greater part of the eastern United States will be cradled in a septic tank, according to this author. The oyster, through its approaching extinction is an index of this increasing contamination. Protection is needed for the populations of the seaboard, and the welfare of those who seek the beaches for health and recreation.

OF all the products which come from nature's vast storehouse of food beneath the seas, none has received the attention of physicians and bacteriologists which has been given to the oyster. Living as it does close to large communities situated on tidewater, and obtaining its food by straining large volumes of water, the oyster may, when eaten raw, become an agency in the transmission of pathogenic bacteria from polluted waters to man. Some instances of typhoid fever in the past have been shown to have been due to eating oysters taken from highly polluted waters, but in other cases there has been at attempt to lay at the door of the oyster blame which rightly belonged on the shoulders of the community. Modern supervision by State and Federal health officials of the waters in which oysters are grown and floated has reduced the dangers of infection from this source to a minimum. Generally speaking, the oysters now obtainable on the market are as safe as our milk supplies.

It is not the relation of the oyster to disease which is to be considered here, but rather the effects upon the oyster and other living forms in our coastal waters, of the waste substances now entering them. In this year of turmoil and unrest we are laying the blame for nearly everything unpleasant on the great war. It will, therefore, be no surprise to you to learn that even the lowly oyster, in its home beneath the waters, has borne its share and more of the destruction involved in this great struggle. The vast industrial expansion, since 1914, in regions close to the shellfish-bearing regions, together with lack of time or of inclination to work out methods of careful refining or proper disposal, has deluged our coastal waters with a flood of industrial wastes which is causing wholesale destruction.

In speaking of pollution in connection with shellfish we generally think of contamination by house sewage. As the effects of human wastes and of trade effluents upon a body of water are entirely different, they must very sharply be defined. Domestic sewage, as a rule, contains little or nothing which is toxic to aquatic organisms. It does contain large amounts of decomposable materials which when broken down yield, among other products, carbon dioxide and nitrates. The presence of these substances causes

a marked stimulation of growth of aquatic plants, mostly microscopic in size, which is followed by an increase in numbers, and often of size, of the animals which feed upon them.

The putrefactive and other bacteria which decompose the sewage and render it available as plant food, are aided in this process by a host of animal forms, all of which work together to bring about the ultimate oxidation of the wastes. Bacteria, plants, and animals together form a highly complex and interrelated group known to biologists and to sanitary engineers as the *biological machine*.

Under favorable conditions a small stream may dispose of the sewage of a relatively large population, and the stream in turn be supplied with a constant source of animal and plant nutriment. There is a true fertilizing action upon the water with a resultant large increase in the numbers of the organisms present. Since fish and shellfish utilize these plant and animal organisms as food, it follows that the addition of domestic sewage to a body of water will result ultimately in an increase in the amount of human food, in the form of fish and shellfish derived therefrom, as truly as though the sewage were employed in fertilizing land crops. Comparative biological surveys made on Lake Monona, Wis., the Illinois River, and the Elbe in Germany, show that an enormous increase in the numbers of aquatic plants and animals follows the introduction of domestic sewage into a body of water.

Shellfish growing in waters contaminated with human wastes are usually very fat, not as is ordinarly supposed because they are eating sawage, but owing to the great number of food organisms which in turn are deriving their nutriment from the products of decomposition of the sewage. In the process of feeding in grossly polluted waters shellfish may take in typhoid bacilli, thus rendering them dangerous as human food until removed for a short time to uncontaminated waters, or otherwise purified.*

The nitrates and other salts essential for plant growth which are produced in the decomposition of sewage, and those which are brought to the streams by the leaching action of ground water upon the land, ultimately pass out to sea and are lost as a source of human food. Only as we utilize the coastal waters for the growing of fish and shellfish are we able to conserve and to transform into human food this continual loss of essential salts from the land. The oyster industry alone produces over $15,000,000 worth of food every year, equivalent to more than 400,000 dressed steers.† Considered in this light, the oyster and other shellfish are true conservators.

The wastes from factories and manufacturing plants of all kinds present an entirely different problem. Here we are dealing with effluents which, though they may contain decomposable materials or some salts essential to plant growth, are in general highly toxic to aquatic organisms. The report of the Committee on Waterways Sanitation presented to the Sanitary Engineering Section of the American Public Health Association at this convention gives a tentative classification of industrial wastes into some 20 or more groups. For convenience we may divide these effluents roughly into the following four classes: (1) acid or alkaline wastes; (2) oil and oil wastes; (3) various chemical substances in solution, such as metallic compounds, dyestuffs, and washings from many industrial processes; (4) precipitates held in suspension.

Natural waters are usually neutral or slightly alkaline in reaction. Experiments of limnologists and physiologists show that aquatic forms are extremely sensitive to changes in the hydrogen-ion concentration of the water. Even a very

*See Wells, W. F., "The Purification of Oysters as a Conservation Measure." Jour. A. P. H. A., April, 1920.

† Moore, H. F., "Oysters, a Little of Their History, and How to Cook Them." U. S. Bureau of Fisheries, Economic Circular No. 18, revised. Issued March 18, 1918.

slight degree of acidity will cause animals to leave a certain area, or will kill those which remain. Caustic soda and lime in high concentration as contained in the effluents from many industrial plants cause a heavy mortality among fishes and other animals.

Oil by spreading a film over the surface of the water, or by coating animals and plants with an impenetrable layer, ultimately kills them either by direct contact, or by preventing free interchange of oxygen and carbon dioxide. From the ease and the rapidity with which it is disseminated, and the small amount which is required to cover a large surface it is, gallon for gallon, one of the most destructive of the foreign substances entering our streams.

Dyestuffs, metallic compounds, and many other chemical substances are poisons with a high degree of toxicity. Even when highly diluted these substances will kill nearly all living forms in a stream for miles below the point of entrance. Precipitates in suspension, such as the waste from pulp mills, canning factories and the like, may fall to the bottom soon after entering a stream and never reach the lower waters. In other cases these precipitates may be carried for long distances and in their decomposition exhaust all, or nearly all, of the stream's available oxygen, causing the suffocation of the animals therein.

The adult oyster, unable to move away, must take the water as it comes to it. Metals or dyestuffs, though present in very minute amounts, are accumulated by the mollusc until its flesh becomes highly colored and even unfit for human food. Analyses of green oysters taken from beds lying from five to ten miles from a copper refinery have shown as high as 20 milligrams of copper per oyster, over five times the normal copper content of the animal. Oil by destroying the organisms which form a large part of the oyster's food, and by reducing free oxidation eventually kills the bivalve indirectly, even though the oil itself never comes in contact with the beds upon which the oyster lies. The oxidation of decomposable precipitates so far exhausts the available oxygen that the oyster may be suffocated.

But long before these effects of industrial wastes are felt by the adult oyster its young have been eliminated. The egg of the oyster develops within six hours after fertilization into a free swimming embryo which moves about in the water partly by its own efforts but chiefly through the action of currents. When one to two days old it develops a pair of tiny shells, between which is protruded the ciliated swimming organ, the velum. With the aid of the velum the little oyster larva ascends to the surface and may spend much time moving about just beneath the surface film. When about 0.32 of a millimeter in diameter it seeks out a shell, or other fixed object, and there attaches itself, to spend the remainder of its life on that spot.

During the free-swimming period, which lasts from 14 to 16 days in waters of the middle Atlantic coast, the larval oyster is exposed to many hazards from enemies, storms, or a sudden fall in temperature. It is extremely sensitive to unfavorable conditions, far more so than is the adult. As if its natural enemies were not enough, the larval oyster must now contend with industrial wastes, and the struggle can have but one ending. A film of oil on the surface of the water will kill molluscan larvæ within a few hours, owing largely to their habit of swimming close to the surface. The effect of other industrial wastes, as shown by Skinner and Sale in Bridgeport Harbor,* is to render the water unfit for the existence of oyster larvæ. The oyster grower depends for his seed upon the larvæ which survive the free-swimming stage and attach to his shells. A few years of successive failure to secure seed and his business is ruined.

Such is the condition now facing Con-

*Skinner, W. W. and Sale, J. W. Paper presented to American Chemical Society. Abstract in Science, N. S. Vol. LII, Sept. 17, 1920.

necticut, Rhode Island and New York, at one time three of the leading states in oyster production. For five years practically no oyster larvæ have set in New England waters. The industry there is now facing extinction. Scientific and practical testimony agree in attributing the chief cause of failure to the great outpouring of industrial wastes incident to the war. New Jersey, Delaware and Maryland, with oyster grounds further removed from industrial centers, have thus far suffered less. The end is inevitable, let present conditions continue, and in ten years the oyster in our northeastern states will be only a memory.

But why do I come to plead the oyster's cause to you, physicians and health officers? If the oyster alone were concerned we could afford to lose it in view of the value of our industrial products. I come to you because the study of conditions in our coastal waters shows clearly the approach of a national calamity. The industrial wastes which kill the oyster larvæ at the same time destroy the biological machine which normally takes care of the self purification of our streams and coastal waters. The stream which a few years ago disposed of large volumes of sewage can now no longer do so, with the result that the banks are strewn with heaps of putrid fecal matter. During the warm months these accumulated masses swarm with flies, adding to the dangers of the situation.

As the poisonous effects of industrial wastes extend further and further downstream the area of bacterial contamination is by so much increased. Pollution has passed far beyond its former bounds and now is invading the bathing beaches and the shellfish-bearing areas which a few years ago were miles from any source of contamination. Evidence from many sources shows that pollution is progressing rapidly down nearly all of our large streams. Unless present conditions are remedied there can be but one result: in 10 to 15 years the greater part of the eastern United States will be cradled in a septic tank.

The disposal of industrial wastes in such a way as to render the effluents harmless when emptied into a stream, and still not impose an undue tax upon the industries concerned, presents a problem which will require the best efforts of chemists and engineers for years to come. As yet we have made scarcely a beginning, but when we consider what the preservation of the natural purity of our waters means to us and will mean to posterity in the future, it is evident that relief from present conditions must be sought without delay.

To this end physicians, health officers, engineers, biologists, fishermen, oyster growers, and hotel keepers and property owners of our summer resorts, must unite in the endeavor to work out a rational solution of the problem. In many instances highly poisonous substances are being thrown into streams merely as the result of carelessness on the part of the offenders and the indifference of the general public. The rapidly increasing population and the industrial expansion of the northeastern part of our country close to the Atlantic seaboard, present a very serious problem. To protect the health of the thousands which flock each summer to the resorts on the coast, as well as to maintain the purity of the water of the shellfish-bearing areas, the flood of poisonous industrial wastes now entering the coastal waters must be curtailed and the natural purity of these waters thereby restored.

INFANT MORTALITY IN DETROIT

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Read before the Vital Statistics Section, American Public Health Association, at San Francisco, Cal., September 15, 1920.

One-fourth of all deaths are among children of less than one year. Babies succumb in large part to causes acting before birth. To prevent such deaths, increasing attention must be paid to prenatal work. Lowest mortality is found among Russian Jews and Italians. Race stocks most in need of prenatal attention are Negroes, Poles, Austrians and native whites.

IN 1906 Detroit's infant mortality rate was 213. Last year our rate was 96.7. This is a substantial and welcome decline.

We find, however, upon inquiry of various large cities that there are some rates lower even than our own.

TABLE I.

INFANT MORTALITY RATE IN U. S. CITIES 1919.
(Deaths Under 1 Year per 1,000 Births, Exclusive of Stillbirths)

Position	City	Rate
1	Pittsburgh	115.
2	Jersey City	102.
3	Milwaukee	97.6
4	Baltimore	97.2
5	DETROIT	96.7
6	Boston	96.6
7	Cleveland	92.5
8	Chicago	90.6
9	Philadelphia	89.8
10	Washington	85.4
11	New York	81.6
12	Cincinnati	79.7
13	Newark	76.2
14	St. Louis	75.3

In fact in 1919 among 14 cities there are nine with lower rates than Detroit.

This circumstance naturally piques local pride and there is an instinctive curiosity to find out why some cities are lower than others. The present paper is an analysis of the factors responsible for infant mortality in Detroit during the year 1919.

Sectional Variations in Infant Mortality Rate.—For purposes of study the city is divided into about 200 small areas or zones. While the rate for the city at large is 96.7, there is great variation in the rates of individual zones. Thus of 138 zones in which there occurred 20 or more births, the infant mortality rates were grouped as follows:

TABLE II.

Infant Mortality Rates from—	Number Zones in Each Group	Per Cent of Zones
0- 49	16	11.6
50- 99	63	45.6
100-149	47	34.1
150-199	10	7.3
200 and over	2	1.4

The highest rate for any zone is 216, the lowest 15.1.

Areas of low and high mortality are scattered over the city. They are not segregated by themselves. In general the west side of the city has a lower infant mortality than the east side. There is also an area of high infant mortality in the northeast section surrounding the village of Hamtramck.

Congestion.—What is there about these zones of high mortality that differentiates them from other districts? Detroit has grown rapidly in recent years and there is much overcrowding. Are the areas of high infant mortality more congested than others?

The ten zones with highest infant

mortality, all above 150, have a baby population per square mile ranging from 96 to 1380, and averaging around 400. We lack population figures to express congestion in total people per square mile.

There are numerous other areas with a still greater baby concentration and yet the mortality is far below 150. Ward 3, Zone 200, for instance, has 2750 babies per square mile and an infant mortality of 81.3.

TABLE III.

Ward	Zone	Babies per Square Mile	Infant Mortality Rate
3	200	2,750	81.3
5	300	2,000	96.7
5	400	1,250	98.7
11	300	1,550	116.
14	300	1,030	57.

A district does not necessarily have a high infant mortality rate merely because it is congested.

As the congested sections are for the most part occupied by people of foreign birth, we may eliminate this influence by observing the effect of congestion in zones 80% or more native born.

TABLE IV.

Ward	Zone	Babies per Square Mile	Infant Mortality Rate
4	200	1,080	98.0
17-C	200	883	52.9
8	200	881	87.3
17-D	200	818	67.0
8	500	807	28.9
8	300	748	70.1
16	100	722	125.
15	400	481	99.6

Ward 8, Zone 500, has 807 babies per square mile and an infant mortality of only 28.9. Ward 16, Zone 100 has 722 babies per square mile and an infant mortality of 125.

It is evident therefore that even in districts largely native American, other factors as well as congestion influence the baby death rate.

Economic Status.—In growing, Detroit has witnessed some of the newer sections become more congested than the older districts. The newer districts attract people of better economic status.

Areas of equivalent congestion frequently are quite different as measured by the material resources of the residents.

We can measure these two factors independently by the mortality rates in certain wards and zones predominatingly native-born white. We have no specific nor exact index of economic status, but it is known from general observation that the economic situation improves as we go from the downtown districts northward in the 2nd, 4th, 6th, 10th and 12th wards. In Table V are given the figures for baby concentration and infant mortality.

As the economic situation improves the infant mortality becomes consistently less. In a general way the baby concentration likewise lessens, but not in the same proportion.

We may say then that an increase in the material assets of the family is conducive to a lowered infant mortality and that this influence is somewhat independent of the degree of congestion.

TABLE V.

Zones	Babies per Square Mile	Infant Mortality
100	502	120.
200	607	90.6
300	483	84.0
400	398	74.2
500	378	32.8

Racial Stock Characteristics.—Passing from a consideration of environmental influences, we may examine the characteristics of each race stock with respect to the baby death rate. It will be recalled from Table II that 16 zones had infant mortality rates less than 50. There were 12 zones with rates 150 and over.

Nine of the 16 good zones are peopled mainly by native-born white. Only one of the 12 bad zones is native-white. One may infer from this that

it is the foreign-born who are responsible for our high infant death rate.

On examining the question more carefully we shall find it necessary to differentiate among the foreign born. All foreign groups do not have high death rates. In fact there are five racial groups with lower rates than the native white. The native white rate is 95, slightly below that for the city as a whole. Those with lower rates are Germany 92, Denmark, Norway and Sweden 88, Great Britain 87, Italy 85, and Russia 64.

At the top of the list (Table VI, Chart I) stands the negro with a rate of 151. This is followed by Greece with 149. Austria, Hungary and Bohemia have a rate of 119, Turkey and Syria 112, Poland 111, Belgium and Holland 111, France 109, Canada 102, and all other countries 107.

TABLE VI.

Infant Mortality by Nativity of Mothers—Detroit, 1919.

Nativity	Births	Deaths under 1 year	Rate
Negroes (mostly U. S.)	587	89	151.
Greece	101	15	149.
Austria, Hungary and Bohemia	2,078	247	119.
Turkey and Syria	170	19	112.
Poland	2,598	289	111.
Belgium and Holland	225	25	111.
France	46	5	109.
Other Countries	589	63	107.
Canada	1,326	135	102.
United States (white)	12,915	1,222	95.
Germany	703	65	92.
Denmark—Norway—Sweden	125	11	88.
Great Britain	747	65	87.
Italy	1,155	98	85.
Russia	1,615	104	64.

We have been searching for the cause of Detroit's relatively high rate. Apparently the foreign-born were to blame, but from Table VI it is evident that the native white are as much to blame as any one. This group accounts for over 50% of the babies and its rate of 95 is the determining factor in the city rate of 96.7. The rate for the entire foreign-born group is approximately 98.4, or but slightly above the native rate. Concentration of corrective efforts among the foreign-born will not materially lower the city's rate. The native rate must also be reduced in order to give Detroit a more favorable position among the cities of the country.

Incidentally it may be noted that the standing of the race groups as found in Detroit confirms, in the main, the experience elsewhere. Thus the 1917 report for the U. S. Birth Registration Area shows Poland with a rate of 172.6, Negro 148.6, United States 93.8, Denmark, Norway and Sweden 66.2.*

Baker and Sobel† give the negro rate for 1919 in New York City as 151, the white rate 79.6. It is also remarked that the Jewish population, presumable mostly Russian, has a very low rate.

Davis‡ describing the situation in Boston in 1911 gives the following rates according to the nativity of the mother:

United States	149
Canada	133
Ireland	123
Italy	108
Russia and Poland	93

There is general agreement in this country as indicated by these reports as to the relatively low baby death rate among Russian Jewish mothers and Italian mothers and a relatively high rate among the negro and native white.

What is there in the racial habits of these various groups which so influences the baby death rate?

At first we are tempted to question whether the accuracy of reporting births is equal among all groups. In the Delray District of Detroit where birth reporting is surely as good or better than in other foreign sections, the mortality rates of Poles and Hun-

*Public Health Reports, June 27, 1919.

† Monthly Bulletin of Dept. of Health of N. Y. City, June, 1920.

‡ American Journal of Public Health, February, 1912.

garians are about the same as those for the entire race group in the city. Birth reporting among the native-born white and colored may be open to slight error, but hardly sufficient to affect the rates materially.

Causes of Death.—To the specific causes of death we may turn for possible enlightenment. In Table VII are given the infant mortality rates for the six race groups about which interest centers, the native white, the negro, Russian, Italian, Austrian, Hungarian, and Bohemian, and Polish. Rates are given for the four principal causes of death, viz:—general diseases (including the acute infectious diseases, also venereal diseases and tuberculosis); respiratory diseases (including the pneumonias and bronchitis); digestive diseases; and diseases of early infancy (chiefly premature birth and congenital debility). These figures are most instructive.

CHART I.

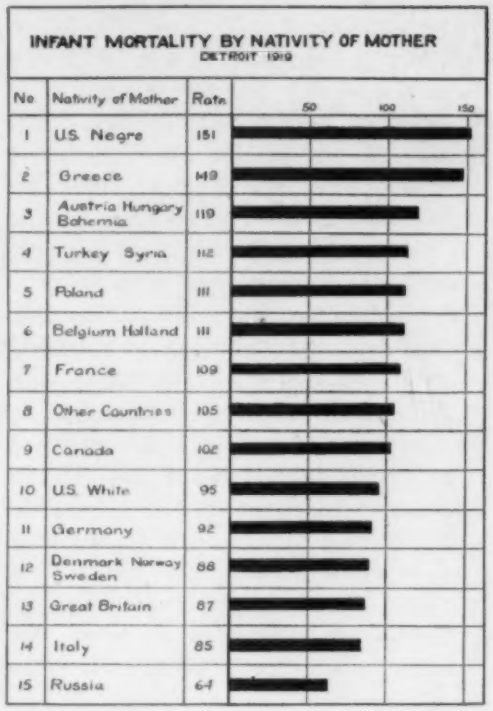


TABLE VII.

Infant Morality by Cause Among Race Stocks, Detroit, 1919.
Deaths Under 1 Year from Each Cause per 1,000 Births.

Nativity of Mother	Cause of Death			
	General Diseases	Respiratory Diseases	Digestive Diseases	Diseases of Early Infancy Including Malformation
Native Born (white)	11.2	13.9	21.4	42.1
Negro	22.2	44.3	25.6	49.3
Russian	10.5	11.8	21.0	19.8
Italian	13.0	30.3	19.9	19.0
Austrian, Hungarian, Bohemian	12.5	29.4	32.8	40.1
Polish	11.9	20.0	33.4	40.0

It has been our experience in Detroit, and this has been confirmed in other cities, that the Russian mother, particularly the Russian Jewish mother, and most of our Russians belong to this group, are thorough believers in breast feeding. The Italian infant is likewise, although to a lesser degree, breast fed. Breast feeding is less rigidly followed among the Austrians and Poles.

Methods of feeding would, therefore, help to explain the difference between the Russians and Italians on the one hand with few baby deaths from digestive disorders and the Polish and Austrian groups on the other hand with their high death rate from these causes.

But the Russian and Italian rates from digestive disorders are not appreciably lower than the native white. The greater frequency of breast feeding among Russian and Italian does not reduce their rate below that of the native

white where breast feeding is relatively less common.

The relation of the races in deaths from respiratory diseases is suggestive at least of a climatic influence. The negro and the Italian, used to warm climates, have the highest rates for respiratory disease. The Russian and the native white are accustomed to cold climates and their rates from respiratory disease are low. The other two occupy an intermediate position as to climate and also in the mortality rate.

Deaths from general diseases are similar for all races except the negro. The negro group has a rate of 22, against an approximate average for the other groups of 12. The deaths from each specific disease are too few in number to warrant generalizations, but there is an indication at least that venereal disease is a prominent cause of deaths among negro babies.

The diseases of early infancy show a wide variation among the race groups. The negro rate is the highest (49.3), and next in a group by themselves are the native white, Austrians and Poles with a rate around 40. Distinctly apart from these are the Russians and Italians with the low rates of 19.8 and 19.0.

Baker and Sobel mention the low rate from congenital causes among Italians and Russians.

It is not easy to find a comprehensive and satisfactory explanation for the above arrangement of the race stocks. There are several bits of contributory information which can be offered. In the first place illegitimacy is more prominent among the negro, and native white.

We know that illegitimacy increases the mortality rate. This would account in a way for the higher negro and native-white rates in deaths from early infancy.

TABLE VIII

Nativity of Mother	Total Births	No. Illegitimate Births	Percent Illegitimate
Negro	587	29	4.9
Native White	12,915	379	2.9
Austria, Hungary and Bohemia	2,078	13	0.6
Poland	2,598	10	0.4
Russia	1,615	3	0.2
Italy	1,155	2	0.2

From observations of our medical and nursing staffs, it appears that the Russian and Italian are distinctly home women. There is less factory employment among them, and the mother is permitted to care for herself better prior to and following the birth of the baby than the Austrian and Polish mother. This circumstance undoubtedly influences the situation materially.

Another fact that has a bearing on this matter is the reaction of the race groups to efforts of public and private health agencies. The Russian and Italian mothers are interested in the field nursing service and are willing attendants at the clinics. Much missionary health work has been carried on among them. More recently the negroes are recognizing the value of this work and are flocking to the clinics in ever increasing number. In the Austrian and Polish sections the nursing service advances more slowly.

Administrative Policy With Reference to the Reduction of Infant Mortality.—There are certain outstanding features in this statistical analysis which suggest lines of administrative procedure looking toward an improvement in our baby death rate.

From 40 to 50% of deaths under one year occur during the first month of life. To lower this toll it is necessary to put forward a vigorous pre-natal program and the native white needs this service fully as much as any other group. Thus 44% of all baby deaths among the native white are due to the so-called diseases of early infancy.

Corresponding percentages for the Pole are 36, Austians, Hungarians and Bohemians 34, Negro 33, Russian 31, and Italian 22.

It is then humanly possible to cut down these deaths in early infancy as the Russian and Italian experience proves. The results of our pre-natal work in Detroit also indicate what it is possible to accomplish. Catering to people in the less well-to-do sections of the city and among whom unfavorable complications were only too frequent it was possible during 1919 and 1920 to keep the infant mortality rate down to 78. By extending the privileges of physical examination and advice to the prospective mother it is felt that many unnecessary deaths among babies during the first month of existence may be avoided.

We may also perceive from this analysis the special need for post-natal work, such as education in baby care and feeding, among the negro and the peoples hailing from southeastern Europe.

There is no intention of discouraging the splendid efforts that are being made by health agencies to keep babies alive after the first month. We do feel, however, that pre-natal conduct is much less well appreciated than post-natal and for this reason there is greater promise of reward in pursuing this line of work. The difference between Russian, Italian, native white and negro in baby deaths from digestive diseases is very slight. It is the Southeastern European groups that need instruction in this subject.

On the other hand the Italian and Russian have just half the baby deaths from congenital and allied causes that the native-white, negro, Austrian and Polish groups do.

To correct this condition a program of pre-natal instruction is called for.

There are innumerable worthy uses for public moneys. One of the purposes of this review is to reveal lines of procedure in which public health funds may be invested most effectively in reducing the toll of infant deaths.

□

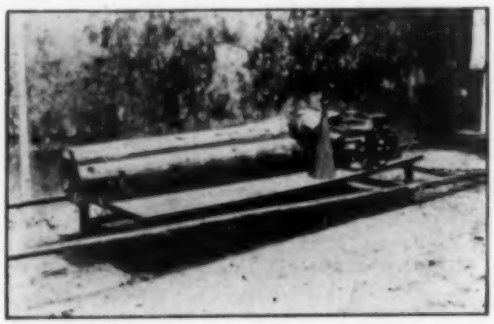
An Open Letter to a Sanatorium Patient.—Realizing how much depends upon the tuberculous patient himself as to his progress when in a sanatorium, Dr. Sidney Barwise, M.O.H. for Derbyshire, hands each entrant of the Derbyshire Sanatorium the following open letter, which is reprinted in his annual report. As a model of what such a document should be, we give it in full: "Once infected with the tubercle bacillus, the germ is in your body for the rest of your life, a 'traitor in the camp,' waiting to take advantage of any abuse of the laws of health or any indiscretion. Your sojourn in the sanatorium is to enable you to break with habits of the past, such as late hours, insufficient sleep, lack of scrupulous cleanliness of home or person, insufficient fresh air, polluted atmosphere, as in music halls or cinemas, apart from the more obvious evils of over-smoking and alcoholic excess. Your stay in the sanatorium is to enable you to build up your strength by living an open-air life, so that when you return to your home you will be strong enough to live with the windows open day and night, and will feel repelled by a close atmosphere. You will be enabled to feel the benefit of breathing cold air, which diminishes the risk of hemorrhage from the lungs, and you will learn how your sputum, which may contain the tubercle bacillus, should be disposed of so that it may not re-infect yourself or infect others. The treatment of consumption is a serious business. You do not go to the sanatorium for a good time, but to learn how to cure yourself. When you return to your home you must continue to practice all you have learned in the sanatorium, and must relax no precaution and neglect no instruction given."—*Medical Officer*, Feb. 12, 1921, 77. (*D. G.*)

CHOLERA PREVENTION CAMPAIGN IN FOOCHOW

A LATE WORK OF DR. W. W. PETER

Americans have achieved a splendid work in bringing into China the principles and practices of the Western medical world. Hospitals and schools have been the results with a long train of successful efforts of the medical missionaries. Public health work in the Western world has turned more and more towards the securing of results through health education of the people, and five or six years ago Dr. W. W. Peter began his remarkable popular work among the Chinese in this line. Aided by the National Medical Association, the Chinese Medical Missionary Association and the Y. M. C. A., the earlier educational campaigns were instituted, the story of which has been published in the JOURNAL (October, 1919, pp. 743-749).

FIGURE 1



Firewood (to boil the drinking water) is better than coffin wood.

Since that time, Dr. Peter has visited two other continents before returning to his work with these people. He spent a number of months in the United States in special studies in sanitation and public health, and afterwards aided in the war work in Europe, giving very essential assistance in the management of a great hospital camp of Chinese coolies. The officers had experienced some difficulties in handling these foreigners, who had come to the country to aid the British, but Dr. Peter knew them and their ways and was able to adjust some of the difficulties.

About eighteen months ago, Dr. Peter returned to China, and from his office there has come to the JOURNAL an outline of the Foochow anti-cholera campaign. The story has been somewhat delayed on account of lack of illustrations, but these have recently been supplied through the courtesy of the International Committee of Young Men's Christian Associations. Cholera caused about 200,000 deaths in China in 1919 and it is well worth the attention of the Western world not only from the humanitarian point of view, but as a measure of self-protection. From endemic centers like these the disease spreads to other countries and its cost even to the United States in money necessary to keep watch of it by our quarantine is quite large in amount. Fighting this and other diseases at the source is the modern development of health administration, and thanks to the active agencies noted and the Red Cross, important preventive measures have been set on foot in the Orient.

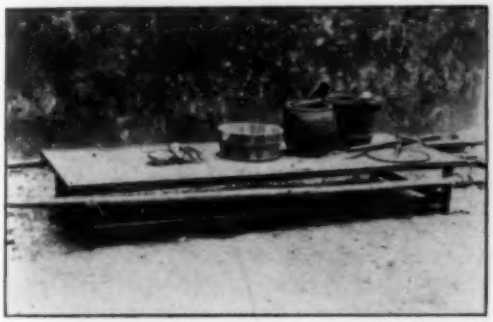
Cholera is a disease of the seasons, dying down when cold weather sets in. The campaign, therefore, was carried on in the middle of last June, with the intention of repeating the spectacle with its educational value whenever necessary.

The previous work in health education in China has been at definite central points. A hall was secured with its exhibition and its explainers, and admission required a ticket. At this time, however, in fighting a disease in one of its strongholds, Dr. Peter real-

ized the need of what he called "hard street fighting," in which if necessary every street in a town would be visited and practically every threshold. For a large place this program was ambitious, and in Foochow he called in his plans for at least a thousand volunteer workers who should be practically free to participate in the parades.

The administration of this campaign was really very complicated and various branches of service were established to include finance, recruits, police, equipment, advertising, women's auxiliary, investigation, halls, ushers, "movie" show and lantern slide meetings, together with some items like relief for the poor.

FIGURE 2

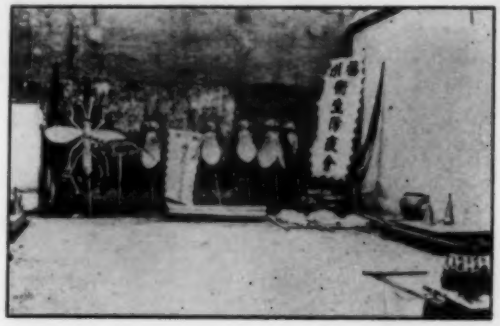


Dish washing, the wrong way.

In his arrangement with Foochow, which was to finance the movement locally, Dr. Peter impressed on the local committee the fact that if the entire health exhibit from Shanghai were desired it would be necessary to provide transportation accommodations for four tons, which for the boat would mean 13 cubic feet. To the credit of the Chinese city, Foochow requisitioned the complete outfit.

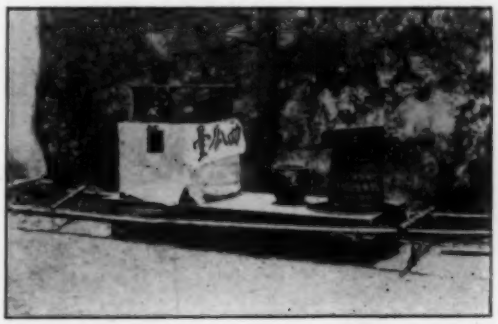
Such a movement does not come to China as a novelty, and in fact the Chinese are quite ready to listen to health lectures. This was evidenced by the fact that especial pains were taken during the Foochow campaign to notify the police and work them into the program. On a previous occasion at Changsa-hunan, the health lecturers neglected to ask for a police detail and the result was that the evening lectures were abandoned on account of the vast crowds, and a number of persons were even injured in the streets because these were crowded by the multitudes wishing to witness the show. In the Foochow campaign the great attention-compelling feature was the parade. First came the governor's military band. This gave recognition to the official, and showed that he was in line with modern progress. Then there were details of civil and military police, and following them were a number of figures such as we see in this country only

FIGURE 3



The banners are inscribed, "Campaign against flies in Foochow."

FIGURE 4



The inscription on the table is, "(Correct) outfit for selling watermelons."

in Mardi Gras festivals or costume parties, all of them focused on the subject of cholera.

The principal of these figures was that of cholera itself, an expert on stilts, mounted as high as the street signs or wires permitted, with a large movable head and jaw, electric light eyes for night use, and hands that could be controlled by the walker. As he walked along he pointed to the various cholera-predisposing factors in the streets by inclining his head, looking at them, or pointing to them. Following him came half a dozen announcers with megaphones. These were after the pattern of American college student "rooters," well trained, and in the command of a leader who gave them the cues. "Behold, there is cholera! Last year cholera caused twenty thousand deaths!" Then they point to the crowd at the street edge. "Do you know! Do you know! Then listen?" Hands are raised in unison and they point together to some nuisance. Then they walk for a distance in dramatic silence. "Salvation is at hand," comes the lusty chorus. "Hear us, O men and women!" Then there is silence; then the grand burst of voices: "But Foochow can be saved! Victory lies within its grasp! But everyone of you must fight for his safety!" One may readily realize the effect of such appeals upon the imaginative dispositions of Orientals.

FIGURE 5

Models of cholera victims, with coffins.

The procession had in it many floats. These floats, however, are of Chinese pattern, a platform borne by men, iittle tables, indeed, furnished with bearing poles, on which were displayed the items to be shown and interspersed between them were the megaphone bands emphasizing the points illustrated by the floats. Coffin wood or fire wood (Figure 1), is one of these, a float on which the megaphones of the bearers may be seen. The moral of this which they pointed out is that it is better to use fire wood to boil your water and thus avoid cholera than to be stricken by the water-borne disease and ensconsed in the coffin wood.

Then might come the float on the care of dishes and household utensils. (Figure 2.) It is a very simple housekeeping outfit. The garbage pail to the right has its cover removed, the water jar next to it, with the curious dipper lying on its top is also uncovered, while there is a rude wooden receptacle and to the left some dishes. Great flies are present, one of them on the edge of the garbage pail and the other inspecting one of the dishes, showing the danger of infection through insects. The flies for this work were made with walnuts for bodies and wings inches in length, but they were pigmies compared with the flies and other insects carried elsewhere in the parade (Figure 3), with banners bearing the legend, "Campaign Against Flies, in Foochow." The legends and the megaphone men gave point to this feature.

A float (Figure 4) labeled, "Outfit for selling watermelons," was a lesson in the protection of foodstuffs from contamination, another float not here presented showed the wrong way with great flies crawling over the luscious fruit. Floats of this kind were considerable in number, dish washing,

right and wrong; the table set for the meal, right and wrong; and food selling, right and wrong, with flies in evidence in all the wrong methods, emphasizing the lesson, that flies can convey cholera.

Unpermissible for public exhibition in this country, but meaning much to the Chinese, were the stretchers bearing models of victims dead from cholera. These figures were especially made to exhibit the drawn features of those who die from this disease, and were borne in the procession (Figure 5), together with their crude wooden coffins.

Two of the masked individuals from the parade are shown in Figure 6, Mr. Cholera Victim and Mr. Wiseman, the former emaciated and ill, the latter, well nourished and jolly. Banners

FIGURE 6

Mr. Cholera Victim and Mr. Wiseman.

FIGURE 7

The legend reads, "Inoculation against Cholera, Chinese Y. M. C. A., 1919, under Dr. Peters' Health Campaign Work."

with inscriptions, groups with the floats, and with the insects, were interspersed between bands of music and the vociferating students yelling forth megaphonically their health lessons.

Cholera comes upon the Chinese usually in June. In 1919 it made its appearance and became unusually violent, the people flocked to the temples with incense and paper money. In their extremity they even carried their usually neglected idols through the streets, hoping that these gods would stay the plague. Even intelligent citizens, who normally disbelieved in the idols were caught in the popular hysteria and gave money to the idol bearers. There were others, however, who realized the real facts, so that when the plan was made to have the anti-cholera campaign in Foochow, there was sufficient financial backing.

There were some sharp corners turned in that health campaign according to Dr. Peter in his letters. There was a personal attack on one of the officials by anarchistic individuals, who sought to secure his death by blowing him up, but this failed. Then after the campaign had really opened there were leaders who called a strike among the half hundred students who were such important factors to the parade. There was an intention to use the occasion for the distribution of semi-political propaganda, and when this was denied, there was trouble. The Association leaders were fortunate, however, in having built up strong friendships among the students, and these as a body elected to desert their old leaders and render this service to society.

Despite some unfortunate conditions of weather there were held 285 meetings with no less than 2,380 volunteer workers, with record audiences, and some 300,000 pieces of cholera literature were distributed. Groups of the people assembled as in Figure 7 for inoculation and other measures were put into force. The result is one of which Dr. Peter and his associates may well feel proud. Up to the close of the season of last year, there was no cholera in Foochow. R.

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Mortality Rates of College Women. — A study of the death rate of college women shows that it is less than one-third the estimated death rate of women of the same age group in the registration area. This result was obtained by collecting data on 15,561 college women, representing all the alumnæ of Vassar, Smith and Wesslesley and aggregating 204,558 years of life. The general death rate was found to be 3.24 per 1,000 for the period of life included, 20 to 64 years. This was compared with rates of women in the U. S. registration area and found to be lower in every age group. The estimated general rate for women of the registration area is about 10 per 1,000 for the 20 to 64 years group. The figures were also compared with the results of a study of New York City school teachers in 1916 and found to be very much in accordance with them. These teachers had been found to have the lowest rates of any New York City employees.

These results are most significant in that they show what can be accomplished in reducing the death rate among those who have certain advantages of living. If the same favorable conditions that college women enjoy could be applied to other classes, the mortality rates would undoubtedly be lower.—M. M. Hulat Quarterly Pub. Am. Statistical Asso., March, 1921.—(*J. A. T.*)

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Comparison of the Wassermann and Sachs-Georgi Reactions in the Serologic Diagnosis of Syphilis.—A diagnosis of syphilis, or a conclusion as to treatment, cannot be based on the results of a Sachs-Georgi test with safety, and the reaction is not suitable for general use for this purpose.—Robert A. Kilduffe, *Arc. Derm. Syph.*, 3, 415 (1921).

PHENOL COEFFICIENTS

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The author states that a phenol coefficient indicates relative germicidal efficiency under laboratory conditions only, and has no practical value. Users of disinfectants ordinarily "follow directions," and employ the dilutions recommended by the manufacturers. This author suggests that we make certain that the recommended dilutions are efficient, and cast aside the coefficient.

THE standardization of disinfectants by means of a carbolic acid coefficient, or phenol coefficient as it is more commonly called nowadays, was originally proposed by Rideal and Walker in 1903. At the time when they published their original article in the *Journal of the Royal Sanitary Institute*[9] a considerable amount of information regarding disinfectants had been made available by the work of many investigators. But the methods used varied so much and so little attention had been paid to establishing standard conditions that it was difficult to compare the results obtained. So, in order to facilitate such comparison, Rideal and Walker devised a method of standardization in which disinfectants are tested alongside of carbolic acid under certain specified conditions, and their relative germicidal values estimated in terms of carbolic acid.

This method was investigated by the Disinfectant Standardization Committee of the Royal Sanitary Institute and in 1906 was recommended by them "for general purposes of standardization."[11] Since then the method has been improved in various ways until now we have the much more exact and accurate method described by Rideal and Walker in 1913 in their article published in the *American Journal of Public Health*.[10]

Although many workers have been able to obtain good results with the R-W method many others, both in England and in this country, have found difficulty in obtaining satisfactory results. Much of this difficulty has been due to failure to observe strictly the standard conditions of the test, and in this country much additional difficulty has been caused by uncertainty in regard to the official standing of the technique described by Partridge[8] in 1907.

On account of the difficulties experienced with the R-W method the Lancet Commissioners devised a method called the Lancet method, which is described in detail in their report published in the Lancet[6] in 1909.

In 1911 Anderson and McClintic, working in this country, brought out a method based on the Lancet method, which they designated the "Hygienic Laboratory" method. This method is described in their original article published in the Journal of Infectious Diseases[1] and also in Hygienic Laboratory Bulletin 82.[2]

The H-L method was investigated by the Disinfectant Standardization Committee of the Laboratory Section of the A. P. H. A. and adopted as an official method, with some modifications made by the Committee. This modified method is described in their report published in the *American Journal of Public Health*[3] in 1912.

The latest phenol coefficient method is that recently devised by another Disinfectant Standardization Committee of the Laboratory Section of the A. P. H. A., the full details of which are given in their report published in July, 1918, in the *American Journal of Public Health*.[4]

The method is based on the H-L method as adopted by the previous A. P. H. A. Committee but a number of modifications have been made. The most important change is the use of an unadjusted culture medium. J. H. Wright made a special study of this matter and the full details of his work are reported in his article published in the *Journal of Bacteriology*.[16] Attention will be given here only to the significance of the change from media adjusted in the usual way to the unadjusted culture medium, as shown by the work of the Committee.

In 1915 a comparative test was made whereby 5 different laboratories undertook to test two special disinfectants by both the R-W and H-L methods, using first the ordinary procedure then in vogue in each laboratory, and second the two methods exactly in accordance with the published technique, using the same strain of typhoid bacillus and the same sample of synthetic phenol for all the laboratories.

In regard to the results, the Committee's report states that the average deviation from the mean with one disinfectant (having a coefficient of about 5), was 10% for the H-L method and 18% for the R-W method, while with the other disinfectant (having a coefficient of about 15) the deviations were 6¼%, for the H-L method and 14% for the R-W method.

As a member of the Committee the writer had occasion to note also the extent of the extreme variations and as these are rather striking they will be mentioned briefly. Using the H-L method with standard technique, the same strain of typhoid bacillus and the same synthetic phenol, coefficients obtained by different laboratories varied from 4.0 and 11.8 respectively, up to 5.4 and 14.8. Using the R-W method in like manner, with standard technique, the same strain of typhoid bacillus and same phenol, one laboratory reported the coefficients of the two disinfectants as 3.3 and 11.00, while another laboratory reported coefficients of 7.0 and 20.0.

In 1916 another comparative test was made, using the R-W and H-L methods with standard technique in all respects, except for the use of the unadjusted culture medium. The difference in results was most marked; the average deviation from the mean in all H-L tests was 6¾% and in all R-W tests 4.6%. The extreme variations of coefficients for the low coefficient disinfectant were from 3.8 to 4.4 by the H-L method and from 3.8 to 4 by the R-W method. For the high coefficient disinfectant the variations were from 12.2 to 14.8 by the H-L method and from 11.1 to 13 by the R-W method.

In view of the results obtained in this second comparative test and the results of Wright's investigations, the Committee adopted the unadjusted culture medium and recommended that its H-ion concentration be determined by the colorimetric method of Clark and Lubs. The most favorable pH is 6.5, but the medium may be used with the pH anywhere between 6.0 and 7.0.

In connection with the Committee's consideration of the results of the second comparative test, Wright called attention to some work which he had been doing which indicated that the really important factor to be considered is not so much the H-ion concentration of the original culture medium as the H-ion concentration of the typhoid cultures used in making the tests. He stated that the coefficient obtained seemed to depend on the length of time the organism had been subjected to any given H-ion concentration. When a typhoid culture is carried along by successive

daily transfers from one broth to another, which is the method followed in all standard methods, the H-ion concentration of the cultures varies with the number of daily transfers that have been made in any particular medium.

Wright found that, for example, with H-L broth having an initial pH of about 5.2 the first one or two daily transfers will show a pH of 4.9 or 5. As the number of transfers is increased the pH increases gradually up to about pH 6.2, after which it remains very constant, this point being reached in from seven to eight days. With Witte's peptone in unadjusted media he found that the pH became uniform in from 4 to 5 days at about pH 6.8 and with Armour's peptone becomes uniform in about 7 to 8 days at approximately pH 7.2. As far as coefficient tests were concerned he stated that the most uniform results were obtained only after the test cultures have been transferred a sufficient number of times to attain the final comparatively uniform H-ion concentration.

The writer has recently made some experiments along this line, the results of which will be mentioned briefly. In the first place, cultures of *B. typhosus* in an unadjusted culture medium made with Armour's peptone if left undisturbed grow steadily more alkaline. For example, in one experiment with four different strains of *B. typhosus* in an unadjusted medium whose pH was 6.7, the pH of the four cultures after three weeks growth was as follows: 9.0, 8.8, 8.8. and 8.3.

On the other hand, where a typhoid culture was carried along in this same culture medium by successive daily transfers, the pH of the cultures after ten transfers remained constant at approximately 7.0.

In another experiment, using an unadjusted culture medium containing more Liebig's extract, the pH of which was 6.3, the pH of four typhoid cultures after 17 successive transfers was as follows: 6.3, 6.1, 6.2 and 6.2. And in a similar experiment with R-W standard broth made with Witte's peptone, the initial pH being 7.3, the pH of the typhoid culture after 14 transfers was 7.1.

In using these cultures in making coefficient tests there were noted perceptible changes in the resistance of the cultures to phenol coincident with changes in the H-ion concentration and uniform resistance when the H-ion concentration remains unchanged.

And now let us ask ourselves "What is the real value of a phenol coefficient as determined under present conditions?" In answer I should say that at the present time a coefficient has no practical value whatever, except as a means of preventing the use of positively worthless preparations and as an aid to the disinfectant manufacturer in maintaining the uniformity of his product.

In the first place, on account of the multiplicity of "standard" methods, any given disinfectant will have as many coefficients as there are methods, and on account of modifications which have been made in the R-W and H-L methods the number of possible coefficients is even greater. The R-W method as now used in England[7] differs from the method as used in this country and the H-L method as now used at the Hygienic Laboratory[14] differs from that described in Bulletin 82. Indeed, lacking any authoritative definition of what "R-W" and "H-L" mean any one is at liberty to use any one of several different forms of these methods and say that the resulting coefficient was obtained by the R-W method, or H-L method.

A much more serious source of trouble is found in the fact that all of these standard methods, except the R-W method now used in England, specify the use of Witte's peptone. As we all know, Witte's peptone is hard to obtain and the English peptone used in the English R-W method is hard to obtain in this country.

But it may be said: "Why use Witte's exclusively? There are lots of other pep-

tones and the exclusive use of Witte's is only a superstition anyhow." In answer to this may be adduced the conclusion reached by Wright[16] who, after examining a number of brands of American peptone found only one that could safely be substituted for Witte's peptone. Furthermore, according to an article appearing in the *Journal of State Medicine* in Feb., 1919,[5] English investigators working in the Research Laboratory of the Royal Institute of Public Health, employing the R-W method with various peptones substituted for Witte's found the coefficient of the same sample of disinfectant to vary from 7.7 to 15.

And, although Witte's peptone has, perhaps, been more uniform in quality than other peptones, it has hardly warranted the implicit trust that has been placed in it. In the English article above mentioned there is the following quotation from the *Lancet* (1916, p. 9): "Even before the war the preparation of a standard broth for bacteriological purposes was a matter of considerable difficulty, since different samples of Witte's and other peptones exhibited such marked variations when employed in nutrient media that the cultural features of an organism were apt to vary with each sample used."

It may seem extravagant to speak of the exclusive use of Witte's peptone as a superstition. But what else can you call our usual practice of employing a certain ingredient in our culture media simply because the label says "peptone" and has some man's name on it, when, as a matter of fact, peptone is only a name which as generally used stands for an indefinite mixture of proteoses, peptones and polypeptides varying enormously in composition, depending on the materials employed and the method of manufacture. It is to be hoped that in due course of time we shall become scientific enough to insist on knowing the real composition of our culture media and prepare them so as to meet the food requirements of the organisms we wish to grow.

The reasons already given are, however, not the only reasons that exist. From the legal standpoint and also by common practice, a phenol coefficient signifies only the relative germicidal value of a disinfectant against *B. typhosus*, and that determined in the absence of organic matter under narrowly limited conditions as to temperature and proportion of culture to disinfectant.

The facts already known in regard to differences in the resistance of various species of bacteria to disinfectants, are almost enough in themselves to make it obvious that no general conclusions can be drawn from a test made only against the typhoid bacillus.

Walters, in an article published in the *American Journal of Public Health*[15] has considered this phase of the problem in a very interesting and able manner. Besides discussing the work done by Churchman and others, he gives the results of his own work with Pine Oil Disinfectant. Stated briefly, these results were as follows: A sample of Pine Oil Disinfectant having a phenol coefficient of 3.8 was found to have so little value against *Staph. aureus* that a 4% solution required an hour or more to destroy that organism, while in contrast to this a 5% solution of phenol killed *Staph. aureus* under the same conditions after exposures of from 5 to 10 minutes.

To the examples of specific action of disinfectants given by Walters I will add the following examples taken from some recent work of my own: Tested under identical conditions Chloramine T was found to kill *B. typhosus* in 10 minutes in a dilution of 1-500, while the same dilution required 30 minutes to kill *B. pyocyaneus*. On the other hand, a dilution of 1-1000 was sufficient to kill *Staph. aureus* in 10 minutes and a dilution of 1-2000 killed it in 30 minutes. Expressed in the form of phenol coefficients the varying activity of Chloramine T against these organisms is as follows: The coefficient with *Staph. aureus* is approximately 23, with *B. pyocyaneus* 2.1, and with *B. ty-*

phosus 16.6. So far as the tubercle bacillus is concerned neither Chloramine T nor any other chlorine disinfectant, is worth very much. For example, a 1-50 dilution of Chloramine T failed to kill the tubercle bacillus in 10 minutes, or diminish its pathogenic power so far as guinea pigs were concerned.

The specific action of disinfectants is discussed in the report of the A. P. H. A. Committee[4] along with two other important factors which influence the action of disinfectants. These are concentration and temperature.

The efficiency of a disinfectant measured by the time required for it to kill a given number of organisms is not proportional to its concentration but to some power of that concentration. For example, with phenol the concentration exponent is six, while with mercuric chloride it is one. The significance of this is shown by the fact that the germicidal value of phenol increases rapidly with increasing concentration, and decreases with equal rapidity with increasing dilution, while mercuric chloride increases and decreases in germicidal power much more slowly.

The effect of temperature may be expressed by saying that while the temperature increases in arithmetical progression the velocity of disinfection increases with geometrical progression.

Since phenol coefficients are determined under certain carefully specified conditions of concentration and temperature while the conditions as to concentration and temperature in practical disinfection vary a great deal and are quite likely to be entirely different from the conditions under which the coefficient was determined, it is evident that a coefficient cannot furnish any reliable indication as to the practical value of any given disinfectant.

In recognition of these facts the Committee has recommended that in addition to the ordinary coefficient the following should be determined: First, the coefficient against other organisms than *B. typhosus;* second, the temperature coefficient; and, third, the concentration exponent or "time ratio."

It might seem from all this that the examination of a disinfectant has become entirely too complicated and yet it seems to me that unless another factor is also taken into consideration all the factors previously mentioned will, in many instances, completely fail to measure the real value of disinfectants. This added factor is the influence of organic matter upon the germicidal power of disinfectants.

It is true that Sommerville and Walker[13] have devised a modified R-W technique for use in determining coefficients in presence of organic matter, although this is not officially a part of the R-W method, and the H-L method includes a modified technique for the same purpose. But in practice these are entirely ignored and when we speak of a phenol coefficient we ordinarily mean a coefficient determined without organic matter.

As a single example of possible error due to ignoring the effect of organic matter I will refer to a disinfectant which I once had occasion to examine. The coefficient of this disinfectant by the H-L method was 10, but it was so seriously affected by organic matter that the additional .4 (4/10) cc. of culture used in the R-W method brought the coefficient down from 10 to 3. Of what value would the coefficient be in this case, even though determined by the A. P. H. A. method, with due reference to other organisms than *B. typhosus* and due reference to the time ratio, concentration exponent, and temperature coefficient?

Finally, a phenol coefficient doesn't tell the user of a disinfectant what he really wants to know. Whether he be householder or public health official what he wants to know is what dilution of any given disinfectant to use for his own particular purpose. And even if the A. P.

H. A. method were in general use, and, in accordance with the Committee's recommendations, coefficients were furnished showing relative efficiency against other organisms than *B. typhosus* and the time ratio, concentration exponent and temperature coefficient were included for good measure, unless the user happened to be a disinfectant expert, and a mathematician as well, he would be none the wiser in regard to the question of what dilution to use.

What the ordinary citizen really does is not to look for a coefficient but rather for the directions furnished by the manufacturer, which he proceeds to follow without question.

What the public health official does I will not attempt to say, although it may be surmised that in many instances he imitates the ordinary citizen and follows directions without question. At any rate, W. G. Savage, in an article published in the *Journal of the Royal Sanitary Institue*,[12] makes the following statement: "I have been surprised in the course of enquiries to find how largely those who use disinfectants for practical public health work, and spend large sums of public money on them, have very little exact knowledge at their disposal to enable them to judge as to the kinds to use, the specific purposes for which to employ them, and the methods of application. They frequently rely upon the statements of the vendors of these substances, statements which cannot be always relied upon."

If this is true for the public health official it is not surprising that the ordinary citizen, with his profound ignorance of disinfectants and their use, relies entirely upon the directions given by the manufacturer, no matter how absurd they are. As an example of such directions I will cite the following, taken from the label on a sample of disinfectant: "For purifying the air of houses, schools, hospitals, etc., dilute one teaspoonful of the fluid with one quart of water and sprinkle about freely." As a matter of fact the dilution recommended would not be sufficient to kill the typhoid bacillus under the conditions of the Rideal-Walker test, a dilution of 1 to 165 being required to kill the typhoid bacillus in 10 minutes under these conditions, while the dilution given is approximately 1 to 236. And, of course, it is all nonsense to expect such a procedure to purify the air.

Since the way we really do things, then, is to follow directions instead of bothering with phenol coefficients it might not be a bad idea to recognize the fact officially and abandon the use of the phenol coefficient. Instead of this, manufacturers of disinfectants could be required to have their products tested against the germs of the various diseases they mention in their literature, the tests being made under conditions simulating natural conditions as nearly as can be done in the laboratory, and they should be required also to recommend the use of dilutions of their products consistent with such tests. A guarantee that any given product had thus been tested and found efficient in the dilutions recommended would be worth more than any coefficient.

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Dysentery Bacillus in Urine of Infant.—There were no vaginitis, pyelitis, cystitis or other urinary complications in this case. The organism was discovered as the result of routine cultures on the 16th and 19th days. Stool cultures on admission and on the three following days, as well as three weeks later, were negative for *B. dysenteriæ*.—C. Creighton, C. E. Wagner and W. C. Davison, *Johns Hopkins Bulletin*, 32, 50 (1921).

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Action of Mercurochromi, 220 on the Gonococcus.—Mercurochrome 220 shows a powerful germicidal effect against the gonococcus. The gonococcus is about 40 times as susceptible to the action of mercurochrome 220 as *B. coli*. Solutions of mercurochrome 220 lost their germicidal potency on standing, and should therefore be used only freshly made.—Ernest O. Swartz and David M. Davis, *Jour. A. M. A.*, 76, 844 (1921).

The Use of Mosquito Nets in the Past.—Sir Patrick Hehir, Major General (retired) of the Indian Medical Service, states in a recent issue of the *Lancet* that mosquito nets were used as a protection against mosquitoes in India by Europeans in 1828. The discovery of the malarial parasite by Laveran occurred long after this date, in 1881. The author suggests that the practice of the Babylonians and ancient Semitic peoples in anointing themselves with oil might have had an anti-mosquito significance. He also quotes from Herodotus, who described a device used by the ancient Egyptians to protect themselves from mosquito bites. It consisted of a fish net wrapped about the person. The Romans used the *conopeum*, or mosquito net, though certain Roman military leaders thought it unmanly to indulge in such protection.—*Mosquito Nets; Their Use in the Past. The Lancet*, March 12, 1921.—(*J. A. T.*)

SPECIAL OBJECTIVES OF PHYSICAL EDUCATION WITH RELATIONSHIPS TO PUBLIC HEALTH

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Sacramento, Cal.

Read before the Session on Child Hygiene, American Public Health Association, at San Francisco, Cal., September 16, 1920.

Most children have no homes, says Mr. Hethrington. Child life and home life have been sacrificed to industry. The home has become a dressing room and refreshment center. Old home functions are shifted to the school. Physical education is one of these, so recently in its new place that it needs interpretation.

PHYSICAL education is a part of education and must be interpreted as a part of the whole. It must be interpreted, however, from a broader point of view than that of the old school subjects or aims.

Physical education has been a part of the school function in some places for many years, but the efforts have been confined largely to corrective aims. Today school physical education, though it includes the older aims, has vastly broader objectives and this change is part of a great transition in the functions of the school.

The old function of the school was to teach the written language: "the three R's." All the rest of education, the big, vital, life-giving phases of education, went on in the home and the community. The home and community taught the real fundamentals in living; the school taught only the accessories, the original so-called fundamentals of school education.

With the rise of machine-dominated industry since 1860, all the home and community opportunities for education have been largely wiped out of existence. The old home industries have gone to the factory; social and recreative activities to public and commercial centers; intellectual, civic and political discussions to the clubs. The modern industrial city, the specialized city residential section and the modern home have been evolved. The cramp of the city has come upon us and its customs in home life have extended to the country.

The child's community educational opportunities have been reduced to impossible back yards, dwarfish front lawns, sidewalks, streets and distant parks. The Playground Movement arose to meet this situation, but not one percent of our child population has access to playgrounds.

The home as an educational institution and child life in the home have been reduced to the dimensions symbolized by a forty-foot or even a twenty-five-foot lot and the tidy cramp of a bungalow, flat or apartment. The home has become an adult dressing room, a refreshment center, with numerous devices to convert sideboards into beds. The educational juice has been squeezed out of the home. Play (Nature's method of education) has no chance, and only the unusual parent can organize educational activities under such conditions. The sign has gone up "No children wanted." Those that are allowed, live in the cramp of an adult convenience. Most children have no real homes. Child life and home education have been sacrificed on the altar of an

organization of adult life for industrial expansion.

Hence we have seen the shifting of the old educational functions of the home and community to the school in the forms of manual training, home economics, industrial and vocational education, social education, moral education, art education, health education, recreational education, civic education and science education, with even suggestions of religious education.

The school has taken on new functions which were the old functions of the home and community. The new school physical education is a part of this movement. Social conditions and the needs of children are compelling the school to take over the systematic organization of the natural physical education that formerly went on in the home and the community.

For this reason, there is probably no phase of education or social effort so seriously in need of interpretation as this new yet old phase of education. The tremendous need for its successful organization is recognized, yet the whole weight of school tradition with its inertia and of the survival of asceticism with its contempt for the physical, and of scholasticism with its contempt for the emotions, and of Puritanism with its contempt for and fear of play, all stand against its successful organization.

The special functions, objectives or aims of the new school physical education must be considered from the following five standpoints:

I. Objectives in the organization of opportunities for and leadership of activities.

II. Objectives in adult adjustment.

III. Objectives in the development of the growing organism.

IV. Objectives in teaching standards of living for self-direction.

V. Objectives in the control of growth or health conditions.

I. The first function or objective of education is the organization of opportunities for and the leadership of activities. Activity is the sole means of education.

Physical education is concerned with physical training or big muscle activities as distinct from the manual activities, linguistic activities, nature study activities, etc., which are the concern of other special phases of education. These big muscle activities are of three classes:

1st. The natural activities or big muscle play, including running and jumping, stunts on the playground or gymnastic apparatus, chasing and fleeing games, swimming and water stunts, boating, tussling and wrestling, athletics, folk games, etc.

2nd. Formalized or invented activities, including tactics, gymnastic drills, special corrective exercises, etc.

3rd. Related activities, including gardening, agricultural projects, industrial work—all activities using the big muscles vigorously, but organized for other than physical training purposes, yet having a physical training value.

The natural activities are those which have gone to pieces under the influence of modern home and community conditions. They are the activities which are being revived on the playground, in the swimming pool, in the gymnasium, and in the organization of hikes and outing activities.

Obviously the only place where the organization of opportunities for and leadership of these activities can be perfected to meet the needs of all the children, is on the school playground, the natural community center of the child's big muscle play activities or physical training.

As activity is the sole means of education, the adult's or society's objectives or aims in education or any phase of education are determined by the educational results of the activities organized and led. These educational results are determined by the mental and physiological

processes involved in the activities and the relationship of these functional processes to the growth, development and social adjustment of the child.

Hence the special objectives or aims of physical education are determined by the mental and physiological processes involved in big muscle activities and the functions or duties of the physical educator or leader of big muscle activities are determined by the leadership of these activities and his relationships to the functional processes and educational results.

These functional processes and results are considered briefly in the following sections on objectives.

II. Social adjustment is the most conspicuous and generally recognized objective of education. It is the remote and extremely complicated objective.

Every child, whatever his race or social status, must learn and become adjusted in some degree to adult customs or ways of living. These customs, the race, in the struggle to live, has developed. They fall functionally under eight headings, and may be listed here without definition merely for reference, as follows:

1. The acquisitive or economic customs.
2. The protective customs.
3. The sex and domestic customs, including sex practices, courting, marrying, home life, and child rearing.
4. The associative-communicative customs, including the forms of speech, and manners in social intercourse, respect and disrespect, etc.
5. The civic customs, or customs in coöperative effort.
6. The interpretative customs, or religious, philosophical and scientific customs.
7. The expressive or artistic customs.
8. The recreative customs.

These customs or ways of behaving in racial adjustment become essential social objectives in child education. The racial forms of living must be acquired. There are, therefore, eight phases in the aims of education from the standpoint of social adjustment.

Society judges the quality of adjustment of every individual under each of these eight phases of adjustment. Society has set up standards. The individual must become adjusted according to racial standards if he is to receive the approval of society.

Applied, these phases and standards of adjustment become criteria for estimating the values of any activity organized by education. Activities must be judged by their values in giving the several kinds of adjustment. For the sake of brevity in this paper the adjusting functions of big muscle activities may be judged in conjunction with their developmental values, which will be considered next.

III. The development of the child is the fundamental objective or aim of education. Every child is born into the world a helpless infant and must go through a long period of growth and development before adult capacities are fairly established. Social adjustment is achieved only through this process of development. The functions or aims of physical education or any phase of education must be interpreted from the standpoint of its special values for development and the relationship of this development to adjustment.

The developmental process must be considered under four phases and the functions or aims of physical education defined under each.

First: In the activities of experience character is developed.

All activities arise out of hungers and instinct tendencies and these tendencies are developed (under the control of satisfactions or dissatisfactions) into desires and impulses and emotional habits, attitudes, and ideals. All activities, therefore, have character training values ac-

cording to the instinct tendencies they exercise.

The functions of physical education in character training bulk large, because big muscle activities are the outcroppings of the fundamental instincts and emotions of human nature. For example: The stunts exercise the achieving instincts; the tag or choosing and fleeing games are all dramatizations of situations in the social relationships of children which exercise the racially old instincts in the acquisition of food and the protection of the self; athletic activities are big muscle, social, fighting plays—they exercise the powerful social, fighting and egoistic instincts and emotions and in precisely the same social relationships in which they function in adult social, business, civic or political struggles. Human character is fundamentally an expression of these instincts. Social life cannot go on a minute without an expression of them. They are developed inevitably. The form of the development determines the fundamental qualities of any character.

The essential thing to recognize in this character-training function of physical education is not that some special abstract character qualities are developed, but the fact that the activities exercise and develop the deepest, most powerful instincts and emotions in human nature. The development may be good or bad according to the leadership, which will be considered later.

Note that this character-training objective of physical education is purely educational, that it is not a "health" aim, and that it is one of the two if not the most profound and important objective of physical education.

Second: In the activities of experience, the intellect is developed and information acquired.

Intellectual development and the acquisition of information are integral parts of the learning process; so is the mastery of the motor mechanisms of the body, which will be considered under the next phase of development.

One of the chief characteristics of the child is his intense curiosity, his great energy in exploration, investigation and experimentation. His tendency is to master the world. Every item of the environment mastered means information about, and ability to think about that item. This process goes on endlessly. Information about, and capacity to think about the environment, ranges from common physical properties up through the subtleties of science and philosophy.

Physical education contributes two fundamental items to this mass of information and skill in judgment:

a. In big muscle activities, skill in making judgments about the physical arrangements and shifting conditions of the environment is developed. Alert attention, the quick size-up of the strategy of the situation, and instant judgment are the very essence of the intellectual functions required in big muscle activities. No other activity in child life gives this kind of development in a comparable degree. Thus big muscle activities give strategic judgment for mechanical adjustments in all phases of life. Who ever heard of an athlete's being run down by an automobile or a street car?

b. Again, in big muscle social activities, insight into human nature is gained. These activities give the most intense social experience of any activities in child life. They are expressions of human nature; they are experiments with human nature. In the actions and reactions of this experience insights and judgment about human nature are developed. While the higher reaches of insight into human nature are gained through the special linguistic activities, the fundamental insights are gained through big muscle play. This development contributes to all phases of social adjustment requiring ability to deal with human nature.

Note again that these intellectual objectives of physical education are purely educational, they are not health objectives.

Third: In the activities of experience the psycho-motor mechanisms are developed. These are the mechanisms of volitional behavior—the linguistic, manual and locomotor mechanisms especially. This development is another phase of the learning process. Here the learning and thinking are focused on the mastery of the body instead of the environment.

All control of the body must be learned. The infant vocalizes instinctively, but he must learn the particular forms of vocalizing involved in the mother tongue. The infant tends to manipulate or play with all the natural objects of the environment, but he must learn how to handle the knife and fork or tools or the pen and learn how to typewrite or play the piano. The infant has creeping, walking and climbing reflexes, but he must learn to balance his body, to creep, walk, run, climb, throw and all the special movements in the infinite variety of games, in swimming, athletics, dancing, etc. Through activity the child develops the capacity to think and will movements. This is the only source of capacity to will any movement.

But this learning of movements does not measure the significance of the developed capacities. In the learning process nervous connections are made and muscle tissues developed. The development of muscle tissues itself is important (every individual should have sufficient muscular strength to perform any of the duties of life without fear of rupturing muscles or tearing ligaments) but natural muscular development is primarily a symbol of nervous development. Nervous development means the drawing out or building up of the latent inherited resources in the nerve centers and their connecting paths for action. The degree of this development of power is determined by the amount and intensity of the activities during the years of growth and Nature gives the impulses for the proper amount of activity in the repetition of play. A boy throws a baseball ten thousand times in order to learn to throw it effectively. So it is with each activity. Through the infinite repetition the nervous centers controlling a movement are developed. Thus nervous power is developed and it is developed in no other way.

For this nervous development, the functions of big muscle activities are of first importance. In these big muscle acitvities all nervous centers of the spinal column, the medulla, the cerebellum, the basal ganglia and the motor centers of the cortex, are involved and developed—all except those centers involved in the finer integrations of the fingers and in vocalization. The whole body becomes integrated as a powerful organ of the will through a well developed nervous system. This development is the source of all the fundamental strengths and skills, of posture and good carriage. It is the source of nervous efficiency for action in all phases of adjustment. It gives special adaptabilities in protective, recreative and vocational adjustments.

Physical education is concerned, therefore, with the development of the capacity to think and will the fundamental movements of life and with the development of the latent integrating functions of the nervous systems for power in action.

Note that these objectives of physical education in psycho-motor development are primarily educational; yet they have an important health value in the power and stability of the nervous functions.

Fourth, and finally, in the activities of experience, organic power is developed. Synonyms of organic power are vitality, vigor, recuperative power, capacity to assimilate food and expend great energy in work or play with a slow onset of fatigue. This phase of development is

the least recognized of all the processes in education because the orthodox study of education has been based on psychology instead of both psychology and physiology.

The functional source of this organic development is combustion. In vocal or manual activities the combustion in the muscles and the nervous centers used causes an increase in local circulation. Out of the exercise of these local nutritive changes comes the great vocal endurance of the public singer or speaker and the great manual endurance of the pianist or typist. In these cases, however, the amount of combustion is not sufficient to heighten appreciably the general circulation or respiration. On the other hand, in big muscle activities (running, for example), the bulk of muscles involved and the amount of combustion are so great that the call for oxygen and the elimination of waste products causes a greatly increased functional activity of the circulatory, respiratory and heat regulating mechanisms and soon of the digestive mechanism.

While we have, generally speaking, no volitional control over the organic functions, we can, by controlling the intensity and duration of big muscle activity, control indirectly and to a fine degree the heightened functional activity or exercise of the organic mechanisms and nutritive processes. In this way we control the development of organic power. The process is best illustrated by the training of the athlete. For example, the distance of the run or the amount of big muscle activity is determined from day to day and thus the amount of activity or exercise of the organic mechanisms is determined. In teaching jargon we "run with our hearts" and "breathe with our legs."

More, in this process we control the amount of assimilation. The athlete according to his temperament, loses weight each day and gains it back by the next day. This recovery of weight without left-over fatigue is the chief guide in training. As the food for this recovery of weight must come from the digestive mechanism the process involves a tremendous heightening of the nutritive functions.

This developmental procedure begins in the squirmings of the infant, continues in creeping and walking and up through all the varied games, stunts and athletic activities of childhood and youth.

The leadership of big muscle activities to gain indirectly the exercise of organic functions and thus the development of organic power is an educational procedure, i. e., the organization of activities for educational ends. It is organic education. It is as accurate an educational procedure as learning to read or write. In some ways it can be more accurately determined.

Organic development apart from the local development associated with vocal and manual skills is purely the product of big muscle activities and thus the undivided function of physical education.

Here is where physical education makes a direct contribution to health. It develops organic power, vitality, vigor. This alone, however, does not guarantee health as there are some fourteen other factors which influence health. Yet it is the only source of organic power this side of heredity. All the other factors are favorable or unfavorable to the proper functioning of the organism, that is, to growth or health. Activity is the only source of the development of the latent powers planted in the organism by heredity.

It is important to note also that physical education in its direct interest in organic development must emphasize the educational rather more than the health objective. This is because exercise has a health value in maintaining nutritive efficiency in adult life and because adults with a refined egoism insist on applying adult hygienic standards to children. According to popular standards twenty minutes of exercise per day is sufficient

for adult health, and adults apply this standard to children. Note our State laws. Experience has shown, however, that children of the elementary school age (if they are to gain the development necessary for efficient citizenship) need between four and five hours of exercise or big muscle activities per day and children of the high school age need between two and three hours. The difference between the two to five hours and the twenty minutes per day indicates the difference in importance between the educational function in developing power through the years of child growth on the one hand and the hygienic function in maintaining efficiency after maturity on the other.

In the four phases of development just enumerated and defined, it has been shown that activities develop latent powers and that these developing powers are moulded to racial ways of living for social adjustment. The race judges the process, sets up standards concerning the quality of the development and adjustment and evaluates the activities according to their worth in giving either development or adjustment or both. As indicated, physical education is responsible for the broad, bulky fundamentals in each phase of development and adjustment. It gives power for action and adjustment rather tha the refinements in action and adjustment. It is the foundation phase of education on which all the rest of education must be built. This brings us to the next objective in education: the teaching of standards of living for self-direction.

IV. Teaching standards of living for self-direction is the super-function, objective or aim of education. Out of it comes the capacity for self-direction according to the laws of hygiene, manners, morals, etc.

The child is, from the beginning, a self-acting organism. But his activities may be good or bad or futile or self-destructive. At first he must be cared for, dominated, controlled, taught, led. As he develops, he gains the ability not only for self-activity, but for self-direction. Gradually he releases himself from the control of the home and the school. The quality of his self-direction will depend on the habits, ideas and ideals established during the period of growth and education.

This capacity for self-direction according to standards, is not the result of a new or different activity in the curriculum or of a different kind of development or adjustment from those already discussed. It is purely the product of the injection of standards of living into all of the activities and into all the development through the quality of the leadership. Teaching standards of living is, therefore, a function of every phase of education and of every teacher. It is an overhead or super-method for all teachers in the leadership of every detail of the educational process.

Physical education, because of the nature of the activities it directs, is charged with training for self-direction in the standards of social behavior and of hygiene.

a. In the leadership of big muscle activities, the teacher is in a strategic position for training and instruction in social habits and ideals. He is literally in charge of the child's chief laboratory activities in social experimentation. His influence is well recognized. It is here that the standardizing leadership loops up with the inevitable character-training tendencies of big muscle activities. Through his intimate association with character expression in the leadership of these acitivities and through the group and individual conferences naturally arising out of his leadership, the teacher must mould social behavior, habits and ideals for good or evil. The breadth of the opportunities for discipline and training are indicated by the tendencies in the expression of human nature in play, to bad manners, to violations of the rules of

the game, to selfishness in avoiding the rules of classification for fairness in competition or eligibility, etc. Sportsmanship is the golden rule applied to the ethics of sport. The lack of a standardizing leadership by an idealizing teacher (for activities are always led, if not by the adult, by the pick-up leadership of some child) is the terror of earnest parents. Every bad habit known to childhood and youth is the result of neglected play—play gone wrong. Every social problem centered in human behavior has its roots deep in this play gone wrong.

This is where physical education contributes to the fundamentals of moral and civic education. While the higher reaches of moral education should come through a personal leadership in literature, history, civics, etc., the training in the basic social habits and ideals must come in the leadership of the more fundamental activities. What is the use of teaching a boy loyalty from a book if he is learning muckerism on the athletic field? Moreover, the big muscle activities, because they are the most fundamental educational activities of child life, can be organized for all the boys and girls of the nation, irrespective of intelligence or social status, in such a manner as will secure standard character-training results; the literary activities cannot be so organized.

b. Again in the leadership of big muscle activities the teacher is in a strategic position for training in hygiene habits. He is literally in charge of the child's laboratory of experimentation in personal hygiene. This arises out of the child's intense interest in his big muscle achievements and his equally intense interest when properly led in his habits and bodily functions as these influence his capacity for achievement. The physical educator is the leader in the child's efficiency for achievement and his leadership is respected accordingly. He is in a position to teach and inspire. He is a trainer in the best sense, and directs, even dictates, not only exercises but diet, sleep, rest, bathing, temperature regulation, cleanliness, avoidance of infections, stimulants and drugs, bad sex habits, bad mental moods, etc. He has the opportunity to "put over" the ideal of maintaining the highest physical efficiency, not merely to win a game, but for all the functions of life.

Teaching hygiene standards is again a divided function. The teachers of biology and home economics especially have deep responsibilities, particularly in giving standard information. Physical educators, however, are in a more strategic position for training in personal hygienic habits.

V. The control of growth or health conditions is an associated objective of education.

Education must control growth or health conditions if it is to realize its aim in development and adjustment in any degree. Education fails and must fail where it attempts to get development and adjustment against growth handicaps. Education, to realize its aims, must remove all handicaps; more, it must make growth conditions favorable to development, not merely tolerable. This means both that teachers must be trained for the functions of growth control or health supervision and that an administrative organization for growth control or health supervision must be established. Both points are important from the standpoint of the functions to be performed.

First I wish to emphasize the distinction between the function of the teacher in growth control and the administrative organization of growth control or health supervision. About the function of the teacher there can be no controversy among those who are thinking of the welfare of the children. About the administrative organization there may be, and frequently is, controversy.

Growth control or health supervision

is a function in some degree of every elementary teacher and the function especially of the physical educator as a teacher. The teacher is the only person conceivable in the school organization in constant contact with the children. He is on the firing line all the time. He is in the strategic position for first line functions in controlling growth conditions. Any efficient control of growth conditions must emphasize this function and train teachers for the function; otherwise the control will be less efficient than it should be or it will be limited by its extra costs and in many rural communities it will not exist at all.

The physical educator or specialized or departmental leader of big muscle activities, because of the nature of the activities he leads and his relationship to organic and nervous development, must be especially alert as to growth conditions. Otherwise the foundation results of education for which he is chiefly responsible will be cramped and thus the whole superstructure made unstable.

As to the administrative organization, that is determined by the special skill needed in growth control and the supervisory and administrative functions to be performed. It may range from a nurse to a corps of nurses and physicians. The leadership of such an organization is purely a matter of determining who is best trained for the performance of the functions. Few instructors in physical education have the training for this administrative function.

The first fundamental thesis of this paper has been to suggest (the space is too limited to prove) that the special functions, objectives or aims of physical education are determined (a) by the natural results in development and adjustment of big muscle activities; (b) by the values of these activities for leadership in establishing standards of living for self-direction; and (c) by the associated necessity, because of responsibilities for organic and nervous development, of controlling growth conditions.

The second fundamental thesis has been to indicate that physical education makes a most profound contribution to health, especially through organic development, yet to confine its functions to health or to classify it as a phase of hygiene is as narrowing for an efficient organization of child education as to classify manual arts or home economics or biology or music as phases of hygiene, because they all contribute to health.

In conclusion it should be noted that we have been discussing the functions of physical education, not the ability of teachers to realize these functions. The functions of physical education or of any phase of school education are not determined by the limitations of teachers. The training of teachers is determined by the objectives of education. The objectives of education must be determined and teachers trained accordingly. Ultimately the success of education and, therefore, of citizenship and civilization depends upon teacher training institutions and especially upon our universities.

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In the July Issue of the JOURNAL look for Reports made at the December Conference at Johns Hopkins on Problems of County Health Work.

REVIEW OF OUR KNOWLEDGE OF BACTERIUM TULARENSE

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Bacterium tularense is associated with diseases of animals in which the lesions are indistinguishable from those of the plague. In man, deer-fly fever is resultant from Bacterium tularense. The organism bears no resemblance to the plague bacillus. Bacterium tularense will grow on egg-yolk medium only.

THE plague-like disease of ground squirrels was first observed by McCoy during the examination of rodents for plague infection at San Francisco, California. The early observations of this writer were published in 1910 and 1911, and in one of these articles is found the following significant suggestion: "——— judging from the large number of species that are susceptible, we are inclined to suspect that man might contract the infection." Such has proved to be the case. In 1914 Wherry and others working in Cincinnati, Ohio, reported two human cases. Again, in 1919, a bacteriologically verified case was reported from Utah by Francis.

The Animal Disease.—This disease is known to occur as a natural infection of ground squirrels throughout middle California and has been found among wild rabbits in Indiana. To experimental inoculation rodents in general, also monkeys, are susceptible in varying degrees. Mice take the disease readily; rats are susceptible, but not highly so. For practical purposes cats, dogs, pigeons, calves, swine, sheep, and goats may be considered insusceptible. From the experimental data it seems probable that the flea is the usual agent in the transmission of the disease among animals under natural conditions.

The gross lesions of the disease vary somewhat according to species, and in any case are practically indistinguishable from those of bubonic plague. The guinea pig, which usually serves as the test animal, contracts the disease readily if even a minute amount of the virus is deposited upon the shaved skin. Death usually occurs in five to seven days. The site of inoculation is found to be necrotic, the contiguous lymph glands are hemorrhagic or caseous; a secondary chain of caseous glands is further found; small yellowish-gray necrotic foci occur in the liver; while the spleen is typically enlarged and thickly studded with these miliary necrotic granules. In some cases large areas of spleen are necrotic. Microscopically the granules are found to be necrotic, often showing much disintegration of nuclei and some surrounding polymorphonuclear infiltration. Guinea pigs which have been inoculated with cultures that have become partly attenuated sometimes develop a chronic form of the disease with marked enlargement of lymph nodes and other organs, which with the necrotic foci presents a gross appearance suggestive of tuberculosis.

The Human Disease.—One of the human cases of Cincinnati was a meat cutter in a restaurant; the other was a housewife who admitted having prepared rabbits for food. In both cases the disease began with a left ulcerative conjunctivitis which was soon followed by a corresponding preauricular and cervical lymphadenitis, fever and prostration. In one case the symptoms were severe, accompanied by delirium, and persisted altogether some seven weeks. The other case was much more mild. Both progressed to a satisfactory recovery.

The human case reported from Utah brings into consideration deer-fly fever or Pahvant Valley Plague, which, to quote from the article by Dr. Francis, is "a disease initiated (according to popular belief) by a fly bite on some exposed surface of the body and manifested by the enlargement of the lymph glands which drain the bitten area and by a fever of a septic type lasting from three to six weeks. The site of the bite and the affected lymph glands become tender and inflamed, and they commonly suppurate. There is marked prostration and the patient is confined to bed. Probably two dozen cases occurred in Millard County in each of the years of 1917, 1918 and 1919." The first case known to have terminated fatally was reported in 1919. This fatal case was shown by bacteriological methods to be an infection by *Bacterium Tularense*, hence it seems altogether probable that this organism is the cause of deer-fly fever. As Dr. Francis' work was undertaken late in the season it was not possible to make a further study of cases nor to investigate the local rodents.

Bacteriology.—By inoculation experiments the virus of this disease is found to be present in very minute amounts of the heart blood of inoculated guinea pigs, in one case 1/100,000,000 cc. having proved infectious. It does not pass a bacterium-proof filter. The thermal death point is about 56° C. for ten minutes.

If the organisms are relatively scarce in the organs their microscopic demonstration is unsatisfactory; if abundant they can be well shown by certain dyes, such as anilin-gentian-violet. With this stain the organism appears as a minute coccus or rod surrounded by a well-defined clear zone.

Whether this is a capsule is doubtful. The utmost length including the clear space is seldom much more than one. micron. The encapsulated appearance is not evident in case of cultural material unless mixed with some substance such as serum to furnish a stained background.

For the cultivation of this organism egg yolk is moderately diluted with salt solution, say three parts yolk to two parts salt solution, and tubed. The tubes are placed in a slanting position in a rack in the Arnold sterilizer, a board having been placed at the bottom to protect them from direct steam. The temperature is then brought up until the thermometer at the top shows a reading of about 73° C., at which it is maintained an hour more or less, according to the size of the tubes. If properly coagulated the surface is found to fluctuate or yield slightly when pressed with the loop. Upon the surface of this medium and in the condensation water the organism grows with sufficient luxuriance, reaching its maximum in about four days at 37° C., in a longer time at room temperature. No other solid medium has been found satisfactory for the purpose. Wherry and Lamb find that "hen's ovomucoid with a trace of yolk is also a satisfactory medium."

The cultural requirements are highly specific, as, so far as is known, the organism grows upon no other medium, and no other organism with

which we are familiar shows the same type of fastidiousness.

Serum Tests.—The relation of the California, Indiana and Utah strains by immunity and serum tests has not been investigated.

For complement fixation tests with human serum the organism should be washed with alcohol and ether to remove lipoid; otherwise lipotropic, in other words, Wassermann - positive serums will react with the antigen, or perhaps with some derivative from the medium. For aggulutination tests a simple emulsion may be used as the lipotropic property of serum does not seem to affect the agglutination reaction. For complement fixation work I heat my lipoid-free material in salt solution to 80° C. for a few minutes, sediment, and preserve the extract with glycerine. These extracts have been found to be highly antigenic and to keep well, at least for some months. They are not hemolytic nor anticomplementary, though fixation is not satisfactory if too much antigen is used.

There are no observations of significance upon human serum from cases of the disease. As far back as 1912 it was shown that certain normal serums react with this organism. These observations have been extended since, and the significance of this phenomenon is under investigation with more rigid control at present.

SUMMARY

Bacterium tularense infection, or the plague-like disease of ground squirrels first mentioned in 1910 has been found widely distributed among these rodents in middle California and has been reported among rabbits in Indiana. Two human cases were reported from Cincinnati, Ohio, in 1914. In 1919 this organism was isolated from a case of "deer-fly fever," an endemic disease in the Pahvant Valley of Utah. Rodents in general and monkeys have been found susceptible to experimental inoculation. In its course and lesions the disease resembles bubonic plague. The organism is of small size and feeble affinity for stains, and, so far as known, egg yolk heated to a rather soft coagulum is the only satisfactory solid culture medium.

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COMPARISON OF TWO METHODS OF ADJUSTING THE HEMOLYTIC SYSTEM FOR USE IN THE COMPLEMENT FIXATION TEST FOR SYPHILIS

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In a series of comparative complement fixation tests the daily adjustment of the hemolytic system based on the titration of complement was found to give more accurate results than the adjustment based on the titration of amboceptor.

IN THE complement fixation test the marked variability of the guinea pig serum used for complement is such as to necessitate the daily titration and adjustment of the hemolytic reagents.

Many workers have followed the original technique of Wassermann and used a fixed quantity of complement in the complement fixation test, compensating for differences in its activity from day to day by varying the amount of amboceptor. Another group of workers has held to the use of a constant quantity of amboceptor, varying the amount of complement.

When the use of a fixed quantity of complement is adhered to, the arbitrary quantity selected usually represents on an average an amount sufficient to hemolyze the sensitized sheep cells which are added as indicator, with an excess to compensate for the anticomplementary substances of normal serum and antigen, guinea-pig serum is variable in its hemolytic activity and also in its sensitiveness to fixation by normal serum and antigen alone; so that this fixed quantity of complement may provide on one day insufficient, and on another day much more than sufficient complement for the hemolysis of sensitized cells after its incubation with normal serum and antigen.

We have undertaken to show that a more accurate adjustment of these anticomplementary substances can be obtained by daily titration of complement and the use of a definite number of hemolytic units. With such an allowance of complement it should be possible to provide the necessary hemolytic unit, and a more accurate approximation of the unit or fraction of a unit required to neutralize the maximum anticomplementary effect of antigen and normal serum.

In order to determine the extent of the variation in hemolytic activity of complement in terms of our own reagents, a

portion of the mixture of guinea-pig sera diluted 1-10 was titrated against a constant quantity of sensitized cells (0.1 cc. of a 5% suspension of sheep cells sensitized with two units of anti-sheep amboceptor. The unit of amboceptor had first been determined by titration with several different specimens of pooled complement). The smallest amount of this mixture of guinea-pig sera necessary to produce complete hemolysis in one hour at 37° C. was considered the unit of complement. Titrations were made with 52 specimens of pooled complement, representing the sera of not less than six, and in some cases as many as twelve, guinea-pigs. One-tenth cc. of a 10% dilution of complement was found to contain as low as one and one-fourth units, and as high as three and one-third units, with an average of two and one-half units.

Before estimate could be made of the number of units of complement to be used in the test, it was necessary to establish the maximum anticomplementary effect of the reagents present. It was found by titration that a control consisting of 0.2 cc. of antigen (twice the amount used in tests) absorbed, non-specifically, slightly more complement than the actual quantity of antigen and serum used in tests, and that this absorption approached but never exceeded one hemolytic unit. It was, therefore, decided that two units of complement would furnish a sufficient excess for use with our reagents to guard against the occurrence of falsely positive reactions.

A series of comparative tests on sera received for diagnosis was performed, using these two methods of adjusting the hemolytic system. The reagents were identical and the tests were done on the same day. In one method, that used in our routine diagnosis, the hemolytic system was adjusted by amboceptor titration. The sheep cells were sensitized with two or two and one-half units of amboceptor as determined by titration with the complement in use, and the complement was employed in an arbitrary fixed dose. (This dose represented two or two and one-half, and often three hemolytic units.) In the other method, the hemolytic system was adjusted by complement titration. A quantity of 5% sheep cells sufficient for the tests to be performed was sensitized with two units of amboceptor, the complement titrated, and diluted so that two units were contained in the quantity to be used in the test.

Of 616 tests performed with plain alcoholic antigen using both methods of adjusting the hemolytic system, 92.8% gave approximately agreeing reactions. Of 1,077 tests with cholesterinized antigen, 82.8% gave approximately agreeing results with both methods. With each antigen the highest percentage of positive reactions was obtained in tests in which the hemolytic system was adjusted by complement titration. The difference in results with the two methods was most marked when there was greatest excess of complement in the arbitrary dose, that is, when the fixed dose represented two and one-half to three and one-third units. Complete clinical data were not available in regard to all the sera tested, but the majority of specimens showing increased reactions through restriction of the complement to two units were from treated cases or from cases with history or clinical signs suggestive of syphilis.

In July, 1920, the method of adjusting the hemolytic system by variation of complement was adopted in our routine diagnosis, and has been used in over 25,000 tests. It has required no more time than the former method of adjustment by variation of amboceptor.

That more delicate results in complement fixation may be obtained by titrating the complement than by titrating the amboceptor has been reported by Ottenberg[1] and[2] and more recently by Kolmer[3]. Their reports, however, have been

based upon tests of a comparatively limited number of sera.

To summarize, in these comparative studies the adjustment of the test on the basis of an amboceptor titration apparently failed to give as accurate results as the adjustment based upon complement titration. The adjustment by complement titration has been shown to be entirely practical even for a laboratory in which a large number of routine examinations are made.

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THE FAMILY DOCTOR AND THE GENERAL HOSPITAL IN THE ANTI-TUBERCULOSIS CAMPAIGN

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What has been done in 38 years of treatment of tuberculosis, according to this author, is merely to care for some of the sick. We have utterly failed in prevention. The problem is not to be solved by the few specialists, but by enlisting the many medical practitioners and opening the general hospitals to cases of tuberculosis.

THE most common of all serious diseases is tuberculosis. A persistent but futile attempt is made to relegate it to specialists in special institutions in special climates, but there is a dearth of specialists, and few patients can afford such treatment. Special institutions are usually located at remote points to which many patients are unable to go because of the sacrifices which a prolonged absence involves. Others, especially those with early or doubtful diagnoses, are unwilling to incur the stigma attached to a sojourn in a tuberculosis hospital, and so, through no fault of his own, the consumptive is the most neglected of all the sick in any community although he is certainly entitled to treatment as adequate and convenient as is commonly available to a person who has pneumonia or itch or any other disease. It is rank injustice as well as a menace to the public health that he is denied it. Let us briefly review the unfortunate situation.

The family doctor, making a diagnosis of tuberculosis, is in a difficult

position. A skeptical patient may call in a less competent physician to contradict him and a very early diagnosis will often be disputed. Recovery from early tuberculosis is probable and will be regarded, by the uninitiated, as evidence of mistaken diagnosis, thus further discrediting the skilled physician, who may, therefore, hesitate to make a diagnosis until the case is no longer doubtful and hence past the point of easy recovery. The general practitioner gives up his patient as soon as he makes a diagnosis of tuberculosis, sending him away to a sanatorium, or merely advising "change of climate," upon which the patient seeks the customary boarding house life of some resort, or else, defiant, resentful, or indifferent he ranges in open rebellion or conceals himself like a wounded animal; in either case cursing the stupid conventions by which he is made an outcast.

The general hospital with a tuberculous patient is also in difficulty. Its rules, reflecting obsolete beliefs, exclude him. The staff is indifferent, the personnel is fearful, chronic cases are unwelcome. The convenient advice, "change of climate," is again offered and the patient is cast out.

The general practitioner is not usually interested in tuberculosis nor in its early diagnosis and treatment. If he were, and knew moreover, that his colleagues were equally skilled, he would not hesitate to make a diagnosis sufficiently early to protect the interests of his patient or to assume responsibility for his care in local hospital or domicile. If the patient knew that a change of climate is not often necessary, he would be easily reconciled to treatment in or near his own home. If the hospital staff had opportunity to treat and hence to become interested in tuberculosis and if the hospital clientele were better informed and more tolerant, it would be a simple matter to provide adequate treatment in convenient places by combining in part the facilities of special and general institutions. When all family doctors are skilled in diagnosis and treatment and wise to foresee and courageous to forestall the development of clinical tuberculosis, even before a definite diagnosis is possible, when ample local facilities for hospital and dispensary care are provided and skilled personnel available therein, we shall have traveled far toward our goal.

A pioneer in this movement is Dr. George Dock of Washington University, St. Louis, who has long taught and consistently practiced the belief that general hospitals should not exclude tuberculosis. He states that the unfortunate practice has resulted in a loss to teaching and says:

"Tuberculous patients suffered, because they could not readily and near at home, get the sort of treatment they needed and that hospitals should furnish."

The National Tuberculosis Association in 1916 adopted a resolution recommending that general hospitals provide care for tuberculous patients. The Surgeon General of the U. S. Public Health Service publicly endorsed that policy in his telegram of April 27, 1920, to the American Medical Association, in which he said:

"I desire to urge more active participation by the general practitioner and by the general hospitals in the treatment of tuberculosis. To insure earlier diagnosis, properly train internes and other personnel, popularize treatment in the home climate, and provide additional facilities, I earnestly endorse the resolution passed by the National Tuberculosis Association in 1916, recommending that general hospitals should admit tuberculous patients and provide separate wards for that purpose. Sanatoriums and special-

ists in tuberculosis will always be needed and we should have more of them, but I believe that success in the anti-tuberculosis campaign is largely dependent upon, first, convenient facilities for observation and prompt treatment of patients with open tuberculosis and second, a sharpened perception and higher degree of skill by which the family doctor will make early diagnosis or even forestall development of clinical tuberculosis in the adult before a definite diagnosis is possible. To provide adequate care for tuberculous ex-service men and others, to protect infants from infection, enlist the aid of the general practitioner, allay phthisiophobia, and improve the home treatment of tuberculosis, the opening of general hospitals to this most common of all serious diseases will materially assist."

Dr. S. S. Goldwater of New York, an acknowledged authority on hospital administration, in commenting upon this telegram, says that the subject is an important public health movement and one that should be kept before the public, the medical profession, and those who are responsible for hospital administration until properly disposed of. He favors a working connection between tuberculosis clinics and general hospitals, saying:

"The contribution of hospitals to the public service would thus be greatly enhanced, the clinics would be strengthened, the public mind would be swept free of harmful misconceptions, and hospital internes, into whose hands the whole public health movement of the future eventually must be committed, would not enter into practice, as they often do today, lacking in the power to make an accurate diagnosis and a reasonably correct prognosis in cases of pulmonary tuberculosis."

The specific cause of tuberculosis was discovered 38 years ago. Surely, no one is satisfied with the results since attained. Battles are not won by stretcher bearers alone and practically all we have done is to remove some of our wounded. We have utterly failed to prevent tuberculosis. Now, after many years, we know that, just as the soil of each newly-plowed garden though clean to look upon teems with invisible weeds, so each healthy human adult harbors a latent infection which becomes clinical tuberculosis under certain rather well-defined circumstances.

The tuberculosis problem, therefore, is not a special but a general one. Not by the few but by the many must it be solved. The family doctor, the general practitioner of medicine, must play a more important part. With a broader outlook and a new vision he must face the fact that upon him in most instances, a harrassed and unenlightened people are dependent for the warnings and admonitions necessary to alleviate stress at critical periods. With a commoner knowledge of tuberculosis and with increased facilities for diagnosis and treatment, there will arise a realization of the fact that an exact diagnosis of tuberculosis in its earliest stages is often neither possible nor necessary. A patient in whom tuberculosis cannot be excluded, but for whom a diagnosis of tuberculosis cannot be positively made, does not usually need sanatorium treatment. Such a patient, if warned against the stresses of life which actuate tuberculosis and given a few weeks' or a few months' régime in hygienic living under careful supervision, will continue, in all probability, free from the clinical manifestations of tuberculosis throughout a long and useful life. The physician treating such a patient may never know whether the patient was suffering from tuberculosis. The patient will not know. It is not necessary that either of them should know

With an increased knowledge of the principles governing the diagnosis and treatment of tuberculosis, will arise the consciousness of this fact, both among the laity and the profession. The most important measures in the prevention of tuberculosis at the present time and for all future time, are unquestionably those which will prevent the development of tuberculosis among persons with tuberculous infections.

If general hospitals are opened to tuberculous patients the man of moderate means can send members of his family there to the course of preliminary treatment which is essential to insure successful home treatment. The régime of unlimited ventilation, the love of freely flowing air, the methods by which a patient is kept warm and comfortable under outdoor conditions of sleeping, the practices regulating rest in bed and diet, as well as the sanitary precautions essential to prevent the spread of infection, can all be inculcated in general hospitals. At the present time thousands of people of moderate means who could afford a short course of treatment in a general hospital, but cannot afford or are unwilling to seek prolonged sanatorium treatment at a distance, are attempting furtively to carry out home treatment under unskilled physicians, handicapped by the lack of necessary preliminary training.

It is through no fault of his own that the general practitioner has not been fully enlisted in this campaign. It is not entirely his fault that he is so poorly equipped to participate. His opportunities are boundless, his responsibilities are obvious and with a knowledge of his proper place in this, the greatest field for medical activities in the world today, a field in which the chosen few have failed, who can doubt that he will live up to the best traditions of his art!

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Zinc Chloride Poisoning. — The authors report an outbreak of dermatosis affecting workmen in a wood preserving plant. Railroad ties were treated by tars and creosotes and by dilute solution of zinc chloride. Four types of skin lesions are described, the first three are well known and attributable to tar. They are dermatitis venenata, tar acne and tar cancer, so called, one of these latter lesions appearing on the scrotum and the other on the forearm. The fourth type of lesions which is the subject of the paper is described as a zinc chloride burn, the multiple lesions appearing on fingers, hands and forearms. All lesions were preceded by slight injury, such as abrasions, splinters, etc. The typical lesions is a small opening in the skin corresponding to size and shape of antecedent injury. Skin surrounding the small opening appears normal, but may be rubbed off, the subjacent area appearing white and bloodless. The small opening contains escharotic tissue. No evidence of infection and little or no swelling were noted. Some lesions were quite painful. Cause of lesions found not to be the dilute solution of zinc chloride used in treatment of ties, but rather the approximate saturation of zinc chloride on surface of ties subsequent to evaporation of solution. Successful treatment by removing escharotic tissue and filling crater with sodium bicarbonate alone or in combination with petrolatum. Prevention was finally effected after much experimentation by the use of flexible "linoleated" canvass gauntlets. The use of these gauntlets together with prompt treatment of trivial injuries to hands and forearms, resulted in freeing the workmen of the zinc chloride lesions.—Carey P. McCord and C. H. Kilker, *Jour. A. M. A.*, Feb. 12, 1921, p. 442.—(*E. B. S.*)

CONQUEST OF MOSQUITO-BORNE DISEASES*

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TO paraphrase an old saying, there is nothing so dramatic in fiction which cannot be equalled in the experiences of everyday life; in this category the story of the conquest of malaria and yellow fever has few parallels. From it we may well learn a lesson in open-mindness in the desirability of at times applying our new experience to those age long problems still with us in our schemes of disease prevention.

RETROSPECT

In unrolling the pageant of the centuries the records of great mean stand out in prominent relief among a deluge of cruelties and oppression, of lives wasted by plagues and pestilence, of kingdoms tottering down to ruin and oblivion, not only by the innate weaknesses of their economic states, but by a concurrent disregard of the accepted responsibilities between individual citizens in every form of civilized contact between its component parts. In these old records it is remarkable how a lessening of the social bonds was invariably followed by calamity, disease and death, all conclusive and annihilating.

To all who have had the opportunity of reading the history of vanished races and civilizations must have come the thought so ably expressed and crystallized by Ruskin: "To those among us, however, who have lived long enough to form some just estimate of the rate of the changes which are hour by hour in accelerating catastrophes, manifesting themselves in the laws, the arts, and the creeds of men it seems to me that now at least if never at any former time, the thoughts of the true nature of our life and of its powers and responsibilities should present themselves with absolute sadness and sternness."

In the records which have been handed down to us of disease and pestilences we can trace in many instances what have been the abiding results upon ancient peoples.

LITERATURE

If we delve into the literature of the classics much is obscure—fable and fancy, mysteries and pagan mythology fill the ancient page and obscure the reasoning of the writers. By careful deduction, however, it is possible to place the events recorded in approximate modern settings.

In the literature of Egypt, Greece and Rome, occasional references will be found to "fevers" or blights, coming upon whole populations. Invariably such catastrophes were looked upon as visitations by outraged deities, for whose propitiation sacrifices, sometimes sanctified with human blood, were offered in appeasement. It is, therefore, remarkable to read that as long as two thousand years ago two writers, Varro and Columbella, affirmed that malaria was directly carried by plagues of flies and mosquitoes.

EARLY RECOGNITION OF MOSQUITO AS DANGER TO HEALTH

In the writings of Josephus, who lived about 37 A. D., an inference may be drawn that the existence of mosquitoes and their danger was noted although in a somewhat mysterious or mystical phraseology. Describing the expedition of Moses against the Ethiopians he says: "Moses took and led his army before their enemies were apprised of his attaching them, for he did not march by the river but by the land, where we have a wonderful demonstration of his sagacity. For when the ground was difficult to be passed over because of the multi-

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tude of serpents which it produces in vast numbers—and indeed is singular in some of these productions which other countries do not breed, and yet such as are worse than others in power and mischief and an unusual fierceness of sight —some of which ascend out of the ground unseen and also fly into the air and so come upon men unawares, and do them a mischief."

As new civilizations arose and fell, vast regions in Asia Minor, Syria and Greece, formerly beehives of teeming life became stagnant and water-logged morasses. Harbors filled up with sand, bars clogged the rivers with silt, soon making great stretches of countryside expanses of marsh and tidal waters. Such must must have been the ideal breeding places for mosquitoes whose active lives would naturally be directed against famished and ill-nourished remnants of peoples, dealing, as it were, the death blow to many a vanishing race. That the ancients were not, however, blind to the simple principles of hygiene is clear in the various health rules taught by the priest-physicians of Egypt, of whom I-EM-HOTEP was the Egyptian original of the Physician God ASKLEPIOS of the Greeks and Romans.

Herodotus, the Greek traveler and historian, who wrote about 420 B. C., described the precautions taken by Cyrus, King of the Persians, to ensure the health of his immediate following: "The Great King (Cyrus) when he goes to the war is always supplied with provisions carefully prepared at home and with cattle of his own. Water, too, from the River Choaspes, which flows by Susa, is taken with him for his drink, as that is the only water which the King of Persia tastes."

"Wherever he travels, he is attended by a number of four-wheeled cars drawn by mules in which the Choaspes water ready boiled for use and stored in flagons of silver is moved with him from place to place."

PLAGUE FEVERS AND THEIR RELATION TO CLIMATE

Malaria and yellow fever, however, as definite disease of so great a scourge as to be looked upon as national calamaties wherever present may be said to be fairly modern in our histories of preventive medicine. Malaria first noted as a European problem, about the time of the Middle Ages, derives its name from the Italian, mal—bad, and aria—air. Such a name aptly described its prevalent association with those justly dreaded marshy lands of the Peninsula where abounded the mysterious fogs, mists and humid airs out of which came the mysterious infection. In the same sense influenza was a coined name to represent an unfathomed disease apparently due to influences undeterminable, obscure and sinister.

Yellow fever undoubtedly an old disease among man has probably existed in tropical and subtropical regions of the globe for ages, only occasionally visiting temperate regions during epidemic periods. So-called from the yellow color of the sufferers, who exhibit an intense jaundice, it was for many years regarded as a form of malaria and only in recent years was given the characterization of a distinct disease entity of very definite and local distribution.

The scourge of the tropics, yellow fever, defied all checks and sanitary measures, killing its victims by the thousand, pursuing its course ruthlessly through the years. The control of the twin diseases, malaria and yellow fever, is truly the romance of modern preventive endeavor.

A BRILLIANT ACHIEVEMENT

In the New World malaria was early recognized as an infectious disease, although little was done to prove the methods of conveyance. It is true that Nott of New Orleans in 1848 was convinced of the spread of malaria by mosquitoes, an opinion upheld by King of Washington in 1882. The final solution

of this world problem was not, however, consummated until a few years ago when Alphonse Laveran, a French army surgeon, assigned to the army in Algeria, noticed in the blood of cases of malaria a curious, crescentic parasite, which he described before the Academy of Medicine of Paris in November, 1880. Seventeen years later Sir Ronald Ross, a British army surgeon, after many disheartening failures and working amid the trying climate of British India forged the most important link in the chain of evidence as to the cause of malaria. By the most delicate of microscopic methods he was enabled to demonstrate the parasite described by Laveran in the stomach wall of the anopheles mosquito when the insect had been allowed to suck the blood of malarial patients. No discovery has more brilliantly crowned the efforts of modern preventive medicine. The mosquito was now revealed as the villain of the piece. Mists, humid fogs, and all the other fancies of ignorance were blown into thin air. Malaria, the scourge of the centuries, was shown to be carried by the bite of a mosquito infected with the blood of a person suffering from malaria.

No more romantic chain of events has ever been chronicled than shown in the further studies of the organism of malaria which was found to have a dual existence, so to speak, one distinctly asexual in man and another distinctly sexual in the tissue of the mosquito. In man the following asexual cycle, or schizogony, occurs. The bite of the mosquito—only of the female mosquito—transfers into the blood of the victim the parasite—*Plasmodium malariæ*. This is a small uni-cellular microscopic body which upon admission immediately attacks the red blood cells, to which it attaches itself and upon which or inside of which it grows. It appears as a small clear body within the blood cells, exhibiting a slow ameboid movement. Growth takes place with the complete destruction of the invaded cells. Later the parasite breaks up into a number of separate segments or sporules, which are discharged into the blood. This discharge corresponds with the chills and fever of the malarial attack and is presumably associated with the release of a toxic substance from the destroyed cells. The cycle of development may vary from two to three days according to the variety of the parasite which is classed as Quartan, Tertian or Aestivo-Atumnal in type.

LIFE CYCLE OF THE ORGANISM

The female mosquito having taken up the blood of the infected person the following, or sexual cycle, sporogony, takes place. The infected blood contains two forms of spores, a small round cell, the microgametocyte, from which small flagellæ are thrown off, the microgametes, and a larger cell the mocrogametocyte from which by the exclusion of a small nucleus the macrogamete is formed. These two parasites fuse to form the perfect cell, the zygote. These zygotes penetrate the wall of the stomach of the mosquito, become encysted under its outer layer where they grow into large bodies, sporocysts, which finally undergo division into small secondary spheres called sporoblasts. The sporoblasts ultimately split up into small spindle shaped bodies, the sporogoites. These latter escape into the body cavity of the mosquito, making their way to the salivary glands from whence they are injected as the mosquito bites its victim.

The cycle of development in the mosquito varies according to the type of the parasite, occupying from 12 days to three weeks.

THE PRACTICAL PROOF

The life history of the parasite of malaria having thus been worked out it remained for the actual experimental proof of the conveyance from man to the mosquito and from mosquito to man. Medical science did not have long to wait

for this. In 1900 Dr. P. Thurber Manson, son of Sir Patrick Manson and Mr. Gerry E. Warren, whilst living in London voluntarily submitted to being bitten by infected mosquitoes sent from Italy and in due time developed attacks of true malaria.

MALARIAL MORTALITY IN ITALY

The actual loss in human lives due to malaria will never be known and cannot be estimated. Some idea of the mortality in malaria ridden countries, however, is shown in the case of Italy where during the ten years previous to 1902, 14,048 deaths from malaria were recorded.

DESTRUCTION OF MOSQUITOES AND QUININE THE REMEDIES

The presence of the malarial mosquito is now shown to be essential in the causation of malaria and in short we can say: No mosquito, no malaria, and conversely no malarial patient, no malarial infected mosquito.

The fight against malaria is, therefore, directed against the species of mosquito capable of harboring the disease, the Anopheles, the destruction of its breeding places, the drainage of swamps and stagnant pools, or if this is not feasible the oiling of these places, or the stocking of them with larvæ-eating minnows or other small fish. The proper covering of all water barrels, buckets, and drains is desirable, although this is not so important as in the case of the Stegomyia mosquito the carrier of yellow fever. Important also is the screening of all houses in malaria districts not only to keep the susceptible mosquito out but to keep the mosquito that has bitten a victim from getting out to infect other persons.

Wherever such measures have been taken it is safe to say malaria has been, if not stamped out, virtually controlled.

In some countries, however, the adequate draining of malarial swamps is too stupendous a task to be undertaken at once. In this case, as in the Italian malarial districts sterilizing of all malarial patients by means of the giving of quinine has produced excellent results. Quinine is now shown to be a sovereign remedy for destroying the malarial organism in the blood itself.

In this method when an attack of malaria is expected 5 grains of quinine are taken daily. At the beginning of an attack 10 to 15 grains are taken followed by 5 or 10 grains every four hours. After the attack the dose is lessened although the drug must be taken for at least 30 days after an attack.

Ten years of quinine prophylaxis following 1902 the deaths in Italy fell from 14,048 as stated above to 3,853. Quinine prophylaxis is, however, only a temporary expedient and does not take the place of mosquito suppression for the reason that although it does prevent attacks of the disease it does not prevent infected persons becoming carriers of the infection for long periods of time.

A NEW SCIENCE

The chain of evidence now being complete there was heralded the new science of Medical Enotomology. The prevention and elimination of malaria was now a simple problem of engineering and sanitation, in which the destruction of the breeding places of the malarial mosquito in marshes and water flooded areas was the first step. Equally necessary was the screening of dwelling houses and the disinfection of the malarial patient by means of quinine.

Thus is written the last chapter in malaria prevention; it needs only the application of those principles laid down to end forever the menace of malaria handed down through the centuries to be solved by science and modern preventive medicine.

YELLOW FEVER—A DISEASE OF TROPICS

The history of yellow fever is more recent than that of malaria, although ancient writers have described it fairly accurately. Formerly supposed to originate from the remittent fevers it was frequently confounded with typhus and typhoid fever. Cullen in 1750 called it

typhus icteroides and Grisolle called it typhus d'Amerique. Flint in 1868 showed it was different from the remittent fevers by the obvious deduction that its course was not modified by quinine or cinchona.

Yellow fever being confined to the warm belt of the earth's surface and seldom found North or South of 38 degrees of latitude, is therefore prevalent in the Gulf of Mexico, West Indies, Central America and parts of Africa.

However, in 1856, 500 cases occurred in the Quarantine grounds of New York Harbor, but in all cases the infection could be traced to ships arriving from infected tropical ports.

PIONEER STUDIES

Yellow fever has been extensively studied in recent years. The exact location of the disease had been accurately mapped and its clinical symptoms made the subject of detailed investigation. The infective material, however, and the methods of infection remained as a sealed book. That the disease was evidently contagious in some form was admitted by early investigators and the results of their deductions did much to direct research work in the right direction. Fenner in 1853 during an outbreak of yellow fever in New Orleans plotted the incidence of 40 cases and proved that the disease occurred in different places among individuals who had not been in contact with each other in the remotest way.

Dowler described an incident in 1805 in which a Spaniard, Don Cabenellos, volunteered to sleep in a lazeretto with his own children where yellow fever victims had died in order to prove its non-contagious nature. With him volunteered a number of galley slaves, the party numbering in all 50 persons. As a result not one of them was taken sick afterward. For this service Cabenellos was made physician to the royal household with an annual stipend of $1,200, a princely gift in those days. One year's imprisonment was also remitted the slaves who accompanied him.

Flint, writing in 1868, stated that the special infective agent of yellow fever could be transported in ships, but that this must be accompanied by high temperature.

A National Quarantine and Sanitary Convention held in New York in 1859 resolved that "in the absence of any evidence establishing the conclusion that yellow fever has ever been conveyed by one person to another it is the opinion of this convention that personal quarantime in yellow fever may be safely abolished."

This failure to establish any theory of contact infection more and more swung medical opinion in the direction of the possibility of some intermediate carrier of the infection. In 1882 Dr. Charles F. Findley stated his belief that yellow fever was related in some way to the prevalence of mosquitoes.

More definite proof of this relationship came in the years 1900-1902. A commission of U. S. Army physicians under the leadership of Major Walter Reed was sent to Cuba to study yellow fever. Disregarding all previous theories and working upon an experimental basis alone definite facts were soon demonstrated. The theory of direct contagion by infected material was soon disposed of by seven enlisted men of the army who volunteered to sleep in infected bedding of yellow fever patients. No disease resulted. In the course of the investigation yellow fever was caused experimentally in 22 instances, 14 by means of bites from infected mosquitoes and 8 by means of the injection of blood or blood serum from yellow fever patients. Dr. James Carroll submitted to a mosquito inoculation and suffered an attack of yellow fever. Dr. Jesse W. Lazear was accidentally bitten by an infected mosquito and died from yellow fever.

The exact infective agent carried by the mosquito was not found at this time.

FINDING THE CAUSE

The mosquito shown to carry the yellow fever contagion was the *Stegomyia fasciata* otherwise named *calopus*. It was found that this mosquito had a wide range corresponding to the latitude in which the disease was endemic.

In habits it was seen to be the direct opposite of the malaria Anopheles. Whereas the latter prefers marshy lands, fields, swamps and stagnant or slowly moving waters, the Stegomyia is a homely insect breeding in any water bucket, cistern or empty cans about dwellings. They do not fly far away, but as Rosenau says, "show a cat-like tendency to remain about their place of birth or adoption."

The result of this brilliant research in preventive medicine was almost immediately made use of in eradicating yellow fever in its ancient kingdom. Major William C. Gorgas of Mobile, Alabama, at the time Chief Sanitary Officer of Havana, Cuba, began a campaign for the eradication of yellow fever in that city (1901). By a systematic scheme of destroying the breeding places of mosquitoes around the dwellings in Havana and by proper screening of all yellow fever victims from contact with mosquitoes, he was enabled within three months to free Havana from yellow fever. The city had never been without yellow fever in 150 years. When the work upon the Panama Canal commenced, by the same methods Gorgas was enabled to make possible the health of the workers on this huge task and to convert "the white man's grave" into a health resort.

INTERNATIONAL HEALTH BOARD

The work so ably inaugurated by Gorgas has been carried on in Central America by the International Health Board of the Rockefeller Foundation. A Commission from this board in 1916 under the direction of Gorgas was organized to locate the endemic foci of yellow fever in Central and South America. In June, 1918, an epidemic of yellow fever made its appearance in Guatemala. With the assistance of sanitary experts supplied by the International Health Board this epidemic was stamped out in a few weeks. The Rockefeller report states "the outcome was especially gratifying and encouraging in that it demonstrated that yellow fever could be controlled with the personnel and facilities available in Central American countries and at a cost well within their financial ability."

The contagion of yellow fever, that is, the definite contagion which is passed from mosquito to man is now within our view.

Dr. Hideyo Noguchi of the Rockefeller Institute as a result of his researches on yellow fever at Guayaquil has isolated an extremely minute spiral organism found in the circulating blood which he has named the *Leptospira icteroides* and which he believes is the infecting agent of yellow fever. It will be interesting to hear of the further life history of this organism in the body of the mosquito.

We have come then nearly to complete knowledge of the causation and spread of the twin scourges, malaria and yellow fever. Our store of information is filled to overflowing and it remains only to see that every human effort be made to apply our hardly-won knowledge to eradicate an age long pest deriving the very foundation of its being from the strong and robust of human kind. No expense in time and wealth is too great a price to pay for security against preventable misfortune.

EDITORIAL SECTION

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STATE ADVICE ON RURAL SANITATION

Within the past five or six years a number of state departments of health in the country have published bulletins with reference to the construction of privies and the disposal of water-carried sewage for individual houses. To the experienced worker in the field of sanitary engineering and sanitation generally these bulletins afford much interesting and useful material, but their value to the ordinary layman is questionable, primarily because they differ greatly in the details of their recommendations and also because they undertake to describe too great a variety of methods of doing essentially the same thing. In short, before these bulletins are published for popular use, the various authors by whom they are issued should get together and develop a consensus of opinion so that the instructions may be simplified and present a greater conformity.

The Sanitary Engineering Section of the A. P. H. A. has been trying to do something of the kind through its Committee on Sewage Disposal, in connection with which there is a sub-committee on Rural Sanitation. Last year at San Francisco this sub-committee submitted a very carefully prepared report covering the whole field of sewage disposal on a small scale. This report represents perhaps the best effort ever made to analyze thoroughly the design of various methods of sewage disposal proposed for small sized installations. It will be printed in a future issue of the Journal. The value of the work of this sub-committee was emphasized by the voluminous written discussion that was submitted and the active discussion that took place at the meeting. The discussion would have been much more prolonged had it not been necessary to shorten it on account of lack of time.

If at the fiftieth annual meeting of the Association in New York City the subject of rural sanitation could be further discussed in the presence of a large representation from state departments of health, there would no doubt result a much better quality of bulletins dealing with construction of privies and small sewage-treatment works. Further than this, such a dis-

cussion would no doubt bring out the desirability of reducing privy construction at least to a simple standard form that might everywhere be recommended. The psychology of the general public is such that it demands not a large amount of fundamental reasoning and various alternatives, but a simple rule-of-thumb method whereby it can meet sanitary requirements. P. H.

MODEL HEALTH CODE FOR CITIES

The March issue of the JOURNAL carried a highly important and valuable report of the Committee on Model Health Legislation. The report consists essentially of suggestions for a model health code for cities. Being published in advance of formal adoption by the Association, it is to be regarded as a preliminary report.

In view of the program of the Association aiming to remove the employment of health officers from politics in so far as possible, the following recommendation in Regulation One of the report has attracted especial interest:

"He [the health officer] shall be appointed by the mayor, subject to the approval of the state health authorities. He shall be subject to removal by the mayor, but may have a public hearing if he desires."

Obviously, the purposes of this provision are to promote the appointment of efficient health officers, and to discourage the practice of removing the health officer for purely political reasons. While there is, doubtless, universal approval of these objectives, it is clear from discussion at a meeting of the Executive Committee of the Association and from various communications, that there is a variation of opinion concerning the method of achieving these ends.

One viewpoint has it that the old board of health has a great deal of merit after all, in that it fosters responsiveness to public opinion and guards against autocracy. It is held that if there is to be a board of health, this board should have real responsibility, which should include the appointment of the health officer.

A second view is that the selection of a health officer should be by a nonpartisan appointing board, it being pointed out that this plan has been very successfully followed in such institutions as state universities.

A third opinion is that the mayor is and should be responsible for the administration of a city. Consequently, it is maintained that the mayor should have a free hand in appointing and removing his department heads.

The Executive Committee of the Association feels that since this report will have great influence in shaping health legislation everywhere, the provisions of the report should receive the most careful study. Members of the Association and others are, therefore, urged to examine the report, and to communicate their views to the Chairman of the Committee on Model Health Legislation, Dr. Carroll Fox, U. S. Public Health Service, Washington, D. C.

The report will again be considered at a meeting of the Board of Directors to be held in June and will come up for general discussion at the next annual meeting, November 14-18, 1921, in New York City.

COUNTY HEALTH ADMINISTRATION

Special attention is called to the reports of the Committee on Sewerage and Sewage Disposal and its sub-committees in this issue of the JOURNAL, Pp. 548 *et seq.*, which include the report and discussion on Rural Sanitation. Following the nast-named broad subject further the JOURNAL for July will contain various reports from the December, 1920, Health Conference at Johns Hopkins University on Problems of County Health Work.

BOOKS AND REPORTS REVIEWED

The Chemistry of Enzyme Actions. *K. George Falk, Harriman Research Laboratory, Roosevelt Hospital, New York City. New York: Chemical Catalog Company, Inc. Pp. 136. Price, $2.50.*

This is the first of the American Chemical Society Monograph Series, the publication of which was undertaken by the Society by arrangement with the Interallied Congress of Pure and Applied Chemistry, which met in London and Brussels in July, 1919. Scientific and technologic monographs, to the number of twelve, have already been announced, but this is the first of the eagerly awaited series to appear.

The series gets a fortunate introduction to the chemical world in having Dr. Falk as the author of the first of the monographs as he is a recognized authority in this field. It may as well be said that this book is not a "laboratory manual" but considers only the "theoretical" side of the subject. In his introduction the author limits his field to a study of reaction velocity, the relation of catalysts to this question, and a study of the chemical nature of enzymes which he defines as "catalysts produced by living matter." But he does not pretend to consider the descriptive side of the subject; nor does he discuss methods of preparation, nor technical laboratory methods of study, nor the enzyme actions of various tissues or extracts.

He considers monomolecular, bimolecular and termolecular reactions of pure chemical substances under definite conditions. This leads him to a general theory of chemical reaction and the effect of catalysts. The definition of catalytic agent is considered in some detail and brings the author to a discussion of chemical reactions catalyzed by enzymes.

A careful survey of the physical properties common to enzyme preparations is then made (hydrogen-ion concentration being considered) and then follows a discussion of the chemical properties. From the chemical nature of certain enzymes the author draws conclusions regarding the mechanism of enzyme action, considerable stress being laid on intermediate addition products.

The sections devoted to the discussion of the uses and applications of enzymes will have a wide appeal and with the concluding chapter on the present status of the enzyme question will be the cause of further stimulating the interest of all who are fortunate enough to read this portion of the book. In this connection he speaks of "industrial application of enzymes, enzymes of metabolism and catabolism, enzymes of plant growth, bacterial enzymes, and enzymes in laboratory work." He discusses the recent production of glycerine by the fermentation of sugar by yeast in presence of sodium sulphite.

The author's grasp of the literature is shown by the frequent and up-to-date references to scientific journals. The book should be in the library of everyone interested in biochemistry.

EDWARD MUELLER.

✣

The Price of Milk. *Clyde L. King, Ph.D. Philadelphia: The John C. Winston Co.*

This work contains a very complete analysis of the varied issues which must be considered in fixing milk prices. Ordinarily, for convenience, these are termed the "law of supply and demand," but the author points in detail to the forces which must be included in this summary. It is contended that these elements are so interwoven as to give the gratifying assurance of fair market prices at all times, for dairymen and milk buyers. Movements looking to the raising or lowering of prices cannot be long maintained by reason of factors beyond human control.

The cost of milk production is conservatively considered on the basis of our present knowledge. It is pointed out that a fairly uniform price is conducive to the economical conduct of the business, and also to stabilizing the use of milk. The book very properly criticises the ownership and operation of distributing and manufacturing plants by farmers, but advocates the coöperation of producers for collective price bargaining, as being in the line of efficient production, distribution and con-

sumption. Economies in distribution are of interest to the public by reason of their importance in fixing prices.

The author is inclined to favor standardization with skimmed milk, but some of his contentions concerning this subject will be questioned, especially his conclusion that, "as milk is tampered with anyway," the objection to standardization "largely falls to the ground." Some will be of the opinion that in the treatment of this problem, the author has not been as fortunate as in his consideration of other portions of his topic. It is stated that the addition of skimmed milk to whole milk "in reasonable quantities" cannot be detected. While this is indefinite as to proportions, there are protein-fat ratios in unmanipulated market milk, which fairly distinguish it from specimens of "market milk" which have been diluted with skimmed milk. He holds that fear of publicity prevents standardizing by responsible dealers, but fails to take into consideration the dealer who claims to be responsible and who standardizes, but by means of extensive advertising is able to control the columns of the newspapers.

Even if the book accomplishes no other useful purpose, it has done much for the milk industry, and the milk consumer, in pointing out that there is no economy to the final buyer through purchasing milk from shops, based on the amount of milk business of the average store. The bottle loss through shop traffic is larger than from wagon trade. By eliminating store sales, and thereby increasing the loads on retail wagons, milk can be delivered cheaper from wagons than from stores. Quality is also maintained at a higher level by wagon delivery alone. Although not favoring the zone system, under which only one dealer delivers in a certain street or territory, an experiment is cited where under this plan dealers made more money with a spread of four cents per quart, than under the old, or ordinary basis, with a spread of five cents per quart.

Relative to municipal ownership, the author is of the opinion that by no test can the milk business be deemed quasi-public business, and that if it is conducted on an ethical and conservative basis, will never be realized. This affords, at least, temporary consolation to the taxpayer.

The book offers an opportunity for ascertaining facts relative to milk production and distribution, and should have a large field of usefulness. It ought to be especially helpful to that group of individuals, who possessing no knowledge of dairying or the selling of milk, give generously by voice and pen, theoretical advice for the conduct of this business.

JAMES O. JORDAN.

✚

Industrial Medicine and Surgery. *Harry E. Mock, M. D., F.A.C.S. Philadelphia: W. B. Saunders Co. Pp. 846, Ill. Price, $12.00 net.*

Until Dr. Mock's book appeared there was no published work dealing broadly with the practice of industrial medicine and surgery and with the problems of industrial health administration.

In a field of activity of as recent development as that of industrial health work, there can be relatively little precise knowledge. It is undoubtedly of value, however, to the many interested industrial and mercantile executives and to industrial, medical personnel to have brought together a summary of present knowledge, to be able to profit by the experience of many of the most able workers in industrial hygiene.

The book is divided into six parts dealing respectively with industrial health service, prevention, industrial medicine, industrial surgery, medico-legal phases and reconstruction. The author, recognizing the complexity of interests involved in the conduct of industrial medical service, freely called upon various contributors for special articles and frankly quoted numerous reports. In so doing there was frequently introduced material having little to do with industrial medicine and surgery. The volume tends towards redundancy in many sections. It could be of fewer pages and still be of unimpaired value to the majority of its readers.

Almost encyclopedic, this book contains much information needed by those concerned with the development of industrial medical service, particularly in connection with large establishments. It is to be regretted that there has been rather little thought of the smaller industrial and mercantile organizations.

Industrial physicians are indebted to Dr. Mock for this useful contribution to the limited literature of industrial medicine.

WADE WRIGHT, M. D.

ASSOCIATION NEWS

SANITARY ENGINEERING SECTION

REPORT OF THE COMMITTEE ON SEWERAGE AND SEWAGE DISPOSAL

Presented to Sanitary Engineering Section, American Public Health Association, at San Francisco, Cal., September 15, 1920.

Last year the Committee on Sewerage and Sewage Disposal presented a report on Rural Sanitation as applied to the collection and disposal of night soil, sewage and garbage. This year the former Committee on Sewage Works Operation and Analytical Methods has been merged with the Committee on Sewerage and Sewage Disposal, which places all questions directly relating to the latter subject in the hands of a single committee. Owing, however, to the importance and character of the work heretofore carried on by the Committee on Sewage Works Operation and Analytical Methods, it has been thought desirable to continue this by a sub-committee.

The work of this committee has, therefore, been divided between two sub-committees: one on Rural Sanitation, consisting of Mr. John F. Skinner, chairman, assisted as *ex-officio* members, by Professor H. N. Ogden of Cornell University, and Mr. John C. Diggs, Sanitary Engineer, State Board of Health of Indiana, and one on Sewage Works Operation and Analytical Methods, consisting of Mr. C. B. Hoover, chairman; Mr. T. C. Hatton and Mr. W. L. Stevenson. A report from the former sub-committee is submitted herewith.

In last year's report on Rural Sanitation particular stress was laid on methods of dry disposal for the wastes from farms and country houses, brief sections covering wet disposal methods having been inserted for the sake of completeness. This year the sub-committee on Rural Sanitation has taken for report methods of disposing of water-carried wastes from separate dwellings and institutions. This report may be considered as supplementary to, or superseding those sections dealing with wet disposal in the report of 1919, namely: Septic Tank, Imhoff Tank, Trickling Filters and Contact Beds, Surface Irrigation, Sub-Surface Irrigation, and Sand Filtration. With this provision the two reports cover the subject of the disposal of rural wastes in a brief but fairly comprehensive manner.

With tanks, as with privies, it is impracticable to specify the precise type and size that is best adapted to each individual situation. Conditions as well as types are too varied. Moreover, in a report of this general nature it is to be assumed that there may be other equally good devices that are applicable in a given case; but the committee has endeavored to outline several simple types that may safely be recommended to the layman and to give in a few words sufficient information to enable him to make a judicious selection.

Due acknowledgment should be made at this time to the valuable assistance furnished by Professor Ogden and Mr. Diggs in the preparation of the report of the sub-committee on Rural Sanitation.

KENNETH ALLEN, Chairman.
T. CHALKLEY HATTON,
JOHN F. SKINNER,
C. B. HOOVER.

REPORT OF THE SUB-COMMITTE ON SEWAGE WORKS OPERATION AND ANALYTICAL METHODS

Presented to Sanitary Engineering Section, American Public Health Association, at San Francisco, Cal., September 15, 1920.

The purpose of this report is to suggest a summarized statement of the main facts relating to sewage disposal to be used by municipalities in their annual reports on this phase of municipal activity. There are two general classes of readers of municipal reports, namely, those who are casually interested and those who are especially interested. The casual reader wants only the main facts, while those who are especially interested want the fundamental data and often considerable detail data.

Many cities are unable to publish a comprehensive report due to fund limitations and

must confine their efforts to a condensed summary. A comprehensive report would probably be passed up by the casual or citizen reader and the condensed summary in narrative style is of little service to the interested reader. If a form of report could be devised which would fit both cases fairly well, it would supply a long-felt need and this report is submitted with the hope that it may at least approach this ideal. Too much detail often obscures the fundamental data which should stand out in bold relief and be readily accessible.

In using this report form, all the numbered sections under A should be included and answered with definite data or marked "not known." Under B all numbered sections should be used. If any particular section does not apply, simply record after it the word "none." For instance, take "B-2 Grit Chambers," if there are no grit chambers in the system of the city the report would record that fact as follows: "B-2 Grit Chambers: none," and the sub-data under B-2 would be omitted. Under "B-7 Oxidizing Devices," if the system has sand filters and no trickling filters or contact beds, omit the two that do not apply and simply report on the one that does apply. Under "C—Operating and Treatment Results," omit only the numbered sections that do not apply and use all numbered sections that do apply even though they must be answered by "not known."

Sewage Disposal—Summary of Data for Year.

A—GENERAL DATA

A-1 Name of municipality and state.

A-2 Population, census of 1890
1900
1910
1920
Present estimated.

A-3 Area of city in square miles.

A-4 Estimated population tributary to works.

A-5 Total capacity of treatment works in M. G. D.

A-6 Total area in acres occupied by the treatment works.

A-7 Year plant was completed and placed in service.

A-8 Character of sewerage system: % separate; % combined.

A-9 Principal industrial wastes.

A-10 Name of stream receiving sewage or treated sewage.

A-11 Minimum discharge of stream in cubic feet per second.
Maximum discharge of stream in cubic feet per second.
Mean discharge of stream in cubic feet per second.
Mean summer flow (May 1st to Nov. 1st) in cubic feet per second.

A-12 Nature of sewage problem:
Prevention of nuisance.
Protection of water supply.
Protection of shell fish.
Protection of bathing beach.

A-13 Population living within radius of one-fourth mile of works.
Population living within radius of one-half mile of works.

A-14 Distance of works from nearest point of corporation line: distance of works from center of city.

A-15 Operating costs per year for past five years.

Where possible, these costs should be separated into cost of pumping, treating liquor, and disposal of sludge. Also separate each of these three main divisions into pay-roll, power, supplies, repairs, etc.

Total cost of treatment works.

Bond charges (interest and sinking fund) per year for past 5 years (separate interest and sinking fund for each year).

B—TREATMENT DEVICES AND OPERATING CONDITIONS

B-1 Screening system:
Brief description.

B-2 Grit chambers:
Number of units.
Dimensions of unit, length, width, depth.
Mean velocity of flow in inches per second.
Mean detention period in minutes.

B-3 Pumping equipment:
Kind of power used.
Type and number of pumps used.
Full load speed of pumps.
Total static head in feet.
Length and diameter of force main.
Maximum rate of pumping in M. G. D.
Minimum rate of pumping in M. G. D.
Mean daily pumpage in M. G.
Total flow for year in M. G.

B-4 How is sewage flow measured:
Maximum rate of flow in M. G. D.
Minimum rate of flow in M. G. D.
Mean rate of flow in M. G. D.
Total flow for year in M. G. D.

B-5 Sedimentation:

	Preliminary treatment.	Final treatment.
Type of tank used.		
Number of units.		
Sedimentation capacity in cubic feet.		
Sludge digestion capacity in cu. ft.		
Average detention period in hours.		

B-6 Sludge treatment:
- Square feet of open drying beds.
- Square feet of covered drying beds.
- Capacity of sludge pressing equipment.
- Scow capacity for deep water disposal.
- Type of filter presses used.
- Effective size of filter cloths.
- Number of filter cloths per press.
- Average thickness of sludge cake produced.
- Foreign matter added to sludge to assist in dewatering.
- Volume or weight of foreign matter added per 1,000 gallons of wet sludge.

B-7 Oxidizing devices:

Sand filters:
- Total area in acres.
- Number of units.
- Depth of sand.
- Average dose in gallons per acre.
- Average daily rate in gallons per acre.

Trickling filters:
- Total area in acres.
- Number of units.
- Kind, size and depth of material.
- Average dose in gallons per acre.
- Average daily rate in gallons per acre.
- Variable or constant head.
- How is variable head secured.
- Average service period in minutes.
- Average resting period in minutes.

B-8 Activated sludge:
- Total effective area of aërating tanks.
- Length, width and depth of aërating tanks.
- Number of aërating tanks.
- Type of air diffusion plates used.
- Ratio of diffusion plates to surface area of tank.
- Total effective area of sedimentation tanks.
- Length, width and depth of sedimentation tanks.
- Number of sedimentation tanks.
- How sludge is removed from sedimentation tank.
- Percentage of sludge contained in aërating tank.
- Percentage of sludge returned to raw sewage.
- Gallons of excess sludge produced per million gallons sewage treated.
- Contact period in aërating tank.
- Maximum velocity of flow through sedimentation tank.
- Cubic feet of free air used per gallon of sewage treated.
- Pressure of air in pounds per square inch.
- Type of dryers used in dewatering sludge.
- Number and size of dryers.
- Capacity of dryer unit in pounds of dry material per hour.

B-9 Sterilization:
- Sterilizing agent used.
- Parts per million available chlorine used.
- Pounds of gas used per M. G.
- Pounds of dry bleach used per M. G.
- Point in treatment where sterilizing agent is added.
- Average contact period of sterilizing agent and sewage.

C—OPERATING AND TREATMENT RESULTS

C-1 Screenings removed in cubic feet per million gallons.
- Efficiency of screens in per cent.
- Moisture content of screenings.

C-2 Grit chamber deposits removed in cubic feet per million gallons.

C-3 Wet sludge removed in cubic feet per million gallons.
- Wet sludge removed in pounds per million gallons.

C-4 Air-dried sludge removed in cubic feet per million gallons.
- Air-dried sludge removed in pounds per million gallons.

C-5 Pressed sludge produced in cubic feet per million gallons.
- Pressed sludge produced in pounds per million gallons.

C-6 Moisture content of wet sludge.

C-7 Moisture content of dried sludge.

C-8 Moisture content of pressed sludge.

C-9 How is sludge disposed of?

C-10 If sold, upon what basis?

C-11 Net revenue from sale of sludge.

C-12 Suspended matter in parts per million:

	Minimum value	Maximum value	Mean value
Untreated sewage.			
Settled sewage.			
Oxidized sewage.			
Final effluent.			

C-13 Settleable solids in cubic centimeters per litre:

	Minimum value	Maximum value	Mean value
Untreated sewage.			
Settled sewage.			
Oxidized sewage.			
Final effluent.			

C-14 Oxygen demand in parts per million after 24 hours at 37 degrees C.

	Minimum value	Maximum value	Mean value
Untreated sewage.			
Settled sewage.			
Oxidized sewage.			
Final effluent.			

C-15 Stability value:

	Minimum value	Maximum value	Mean value
Untreated sewage.			
Settled sewage.			
Oxidized sewage.			
Final effluent.			

C-16 Dissolved oxygen in parts per million:

	Minimum value	Maximum value	Mean value
Untreated sewage.			
Settled sewage.			
Oxidized sewage.			
Final effluent.			

C-17 Nitrites and nitrates per million:

	Minimum value	Maximum value	Mean value
Untreated sewage.			
Settled sewage.			
Oxidized sewage.			
Final effluent.			

C-18 Miscellaneous or special operating or treatment results:

NOTE: C-13 and C-15 are recommended as a minimum testing schedule for non-technical operators. It is also recommended that composite samples made up of portions collected at hourly intervals through the day, or through the full period of 24 hours, be used for the laboratory tests and analyses.

It is recommended that the samples be stored on ice and that a constant temperature incubator be used.

C-16 should be determined on one or more special samples, all other determinations being made on iced composites. Nitrites and nitrates to be determined together by the reduction method. When possible, settleable solids should also be expressed in parts per million.

When stability by methylene blue test is expressed in hours that color is retained, the temperature of incubation should be given.

C. B. HOOVER, CHAIRMAN.
T. CHALKLEY HATTON,
W. L. STEVENSON.

□

REPORT OF THE SUB-COMMITTEE ON RURAL SANITATION

Presented to Sanitary Engineering Section, American Public Health Association, at San Francisco, Cal., September 15, 1920.

It was intended to offer a review of the literature and an extended bibliography of the subject; circumstances, however, have made it feasible to limit this portion of the work to a brief list of articles.

There is also presented a statement of principles to be observed, type plans for plants of various capacities and recommendations, for the aid of rural dwellers and public health officers.

I.

PRINCIPLES TO BE OBSERVED

1. **Wastes to be Treated.**
   - A. Sanitary or closet wastes, water carried.
   - B. Bath, sink and kitchen waste.
     (In case of a large kitchen supplying an institution, a grease trap may profitably be installed on the kitchen drain before it joins the main sewer.)
   - C. Dairy waste, if large in amount, should be treated separately, the sludge precipitated with alum or iron, and only the effluent admitted to the sewer.
     (This properly comes under "industrial wastes.")
   - D. Stable waste should be screened to exclude straw, feed and other solids, after which the liquid wastes and a limited amount of wash water may be admitted to the sewer.
     (Gasoline and wash water carrying mainly inorganic solids should be excluded.)

2. Choice of System of Treatment.

A. Discharge into large or non-potable stream.

(a) Remove floating and coarse solids and grease by septic tank or by biolitic tank followed by settling tank.

(b) Discharge through submerged outlet.

B. Discharge into potable stream or into small stream whose waters are drunk by cattle, or upon a bathing beach.

(a) Remove grease and solids by Imhoff tank.

(b) Oxidize on sand filter or on trickling filter.

(c) Discharge through submerged outlet.

C. Discharge upon soil, no stream available.

(a) Remove grease and solids by septic, biolitic or Imhoff tank.

(b) a. If remote (at least 500 feet from dwellings) and land is available, discharge intermittently into furrows of irrigation field, growing crops on the ridges.
(Vegetables which are eaten raw should be excluded.)

b. Discharge intermittently into subsoil distributing tile.

(1) If the ground is sufficiently dry and porous, this will be sufficient.

(2) If the ground is not sufficiently dry and porous, lay another system of drains midway between the distributing tile, one foot lower and leading to a free discharge.

(3) If soil is heavy, in addition to the last method (2) lighten the soil by deep plowing and by mixing in sand or cinders.

D. For a hotel, an institution, or a community of several hundred people, where power and daily attendance are available, and where a non-potable stream receives the discharge.

(a) Remove coarse solids and grease by self-cleaning fine screen and scum board.

(b) Discharge, as fresh as possible, through submerged outlet.

II.

DETAILS AND DIMENSIONS OF PLANT UNITS.

1. Basis of Design.

A. Septic tank.
Capacity: ½ day's flow + 1 cu. ft. per capita (minimum size 10 persons).
$L = \pm (b + h)$ or $\pm \sqrt[3]{V}\ bh$.

B. Biolitic tank.

(a) Agitation Chamber. Capacity: ⅓ day's flow. Square in plan with hopper bottom; hopper one-half total depth. Bottom slopes, 4 vertical on 3 horizontal.

(b) Settling Chamber. Capacity: ⅙ day's flow + 1 cu. ft. per capita. Area same as Agitation Chamber.

C. Imhoff tank.

(a) Settling Chamber. Capacity: ¼ day's flow; twin channels; rectangular in plan; bottom slopes, 4 vert. on 3 hor.; slot, 4 inches; gas trap 5-inch horizontal.

(b) Sludge Chamber. Capacity: 2 cu. ft. per capita from bottom to level 8 inches below slot.

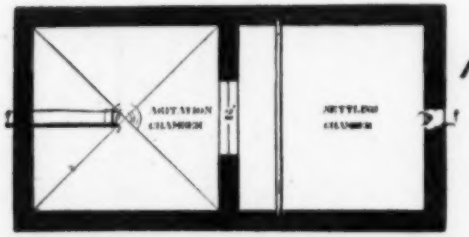
(c) Gas vent. Length of tank and not less than 12 inches wide.

(d) Sludge pipe. 4-inch C. I. soil pipe.

D. Trickling filter.
Capacity: not over 36 gallons per sq. ft. daily nor less than 8 cu. ft. per capita.
Material: broken stone, brush or lath.
Plan: rectangular or hexagonal.
Depth: 4.5 ft. to 6 ft.

E. Sand filter.
Capacity: not more than one gallon per sq. ft. daily; not less than 87 sq. ft. per capita.

F. Broad irrigation.
Not less than 436 sq. ft. per capita.
Not less than 10 sq. ft. per gal. daily.

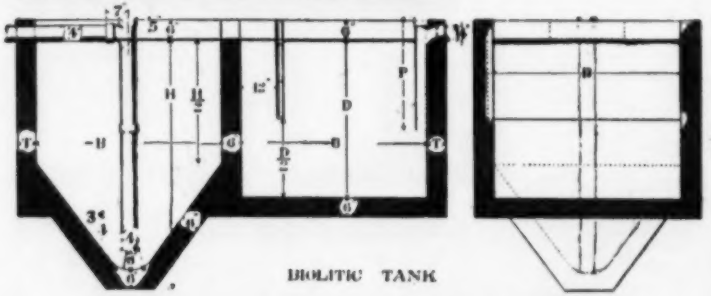


AMERICAN PUBLIC HEALTH ASSOCIATION
PLANS FOR ISOLATED SEWAGE DISPOSAL PLANTS
SEDIMENTATION AND DIGESTION UNITS

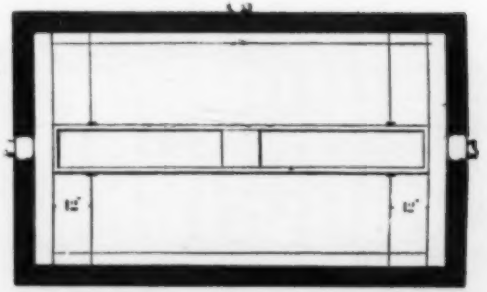
SANITARY ENGINEERING SECTION

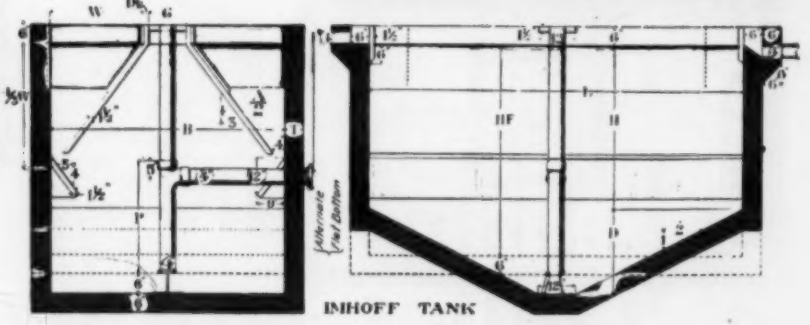
Committee on Sewerage and Sewage Disposal — Sub-Committee on Rural Sanitation

September, 1920

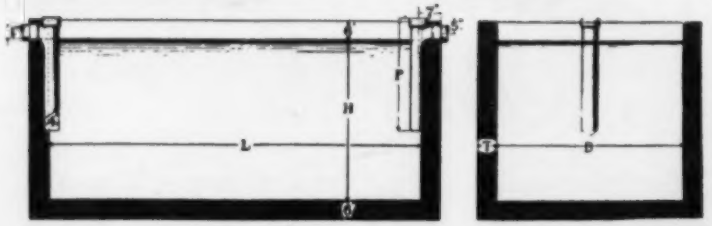


BIOLITIC TANK





INHOFF TANK



SEPTIC TANK

UNIT	DIMENSIONS	Letter	10 Persons @ 30 Gals = 300 Gals	20 Persons @ 40 Gals = 800 Gals	50 Persons @ 50 Gals = 2,500 Gals	100 Persons @ 60 Gals = 6,000 Gals
SEPTIC TANK	Length, inside	L	5'-0"	6'-0"	10'-0"	12'-6"
	Breadth, "	B	2'-0"	3'-6"	5'-0"	6'-0"
	Height, Bottom to Water Line	H	3'-0"	3'-6"	4'-4"	5'-0"
	Thickness of Wall	T	6"	6"	6"	8"
	Length of C. I. Soil Pipe T-T	P	2'-0"	2'-6"	3'-0"	3'-0"
BIOLITIC TANK	Breadth of Square Chamber	H	2'-6"	3'-6"	5'-0"	6'-3"
	Height of W. Agitation, " Settling	H	3'-4"	4'-6"	6'-8"	8'-0"
		D	3'-4"	3'-4"	4'-3"	5'-3"
	Thickness of Walls	T	6"	6"	6"	6"
	Length of C. I. Soil Pipe T-T	P	2'-0"	2'-6"	3'-0"	3'-0"
INHOFF TANK	Length, inside	L	5'-0"	6'-0"	10'-0"	12'-0"
	Breadth, "	B	4'-0"	5'-0"	6'-3"	8'-4"
	Width of Settling Channels	W	1'-5"	1'-10"	2'-6"	3'-4½"
	Gas Shelf	G	1'-5½"	1'-6"	1'-6"	1'-6"
	Height of End Wall, Bottom to W.L.	H	2'-4½"	3'-3"	4'-4½"	5'-6"
	" " for Flat Bottom	HF	3'-4"	4'-5½"	5'-7½"	7'-1"
	Depth of Sloping Bottom	D	1'-0"	1'-3"	1'-3"	1'-3"
	Thickness of Walls	T	6"	6"	6"	8"
	Length of C. I. Soil Pipe T-T	P	2'-0"	2'-6"	3'-0"	4'-0"
	Cross Section of Settling Channel	A	2 sq. ft.	2.5 sq. ft.	3.5 sq. ft.	4.7 sq. ft.

G. Subsoil irrigation.
   (a) Area of tile field: Not less than 100 sq. ft. per capita, nor less than 2 sq. ft. per gal. daily.
   (b) Tile distributors.
      a. Length, 20 feet (average) per capita, depending on the soil.
      b. Spacing, gallons per capita ÷ 10, but not less than 5 ft.
      c. Diameter, 2 inches, up to 50 gals. per capita and 16 discharges daily; 3 inches above 50 gals. per capita, daily.
   (c) Number of discharges daily = daily flow ÷ contents of tiles, but not over 16.

2. Dimensions of Units are Exhibited in Table 1.—(Page 553.)

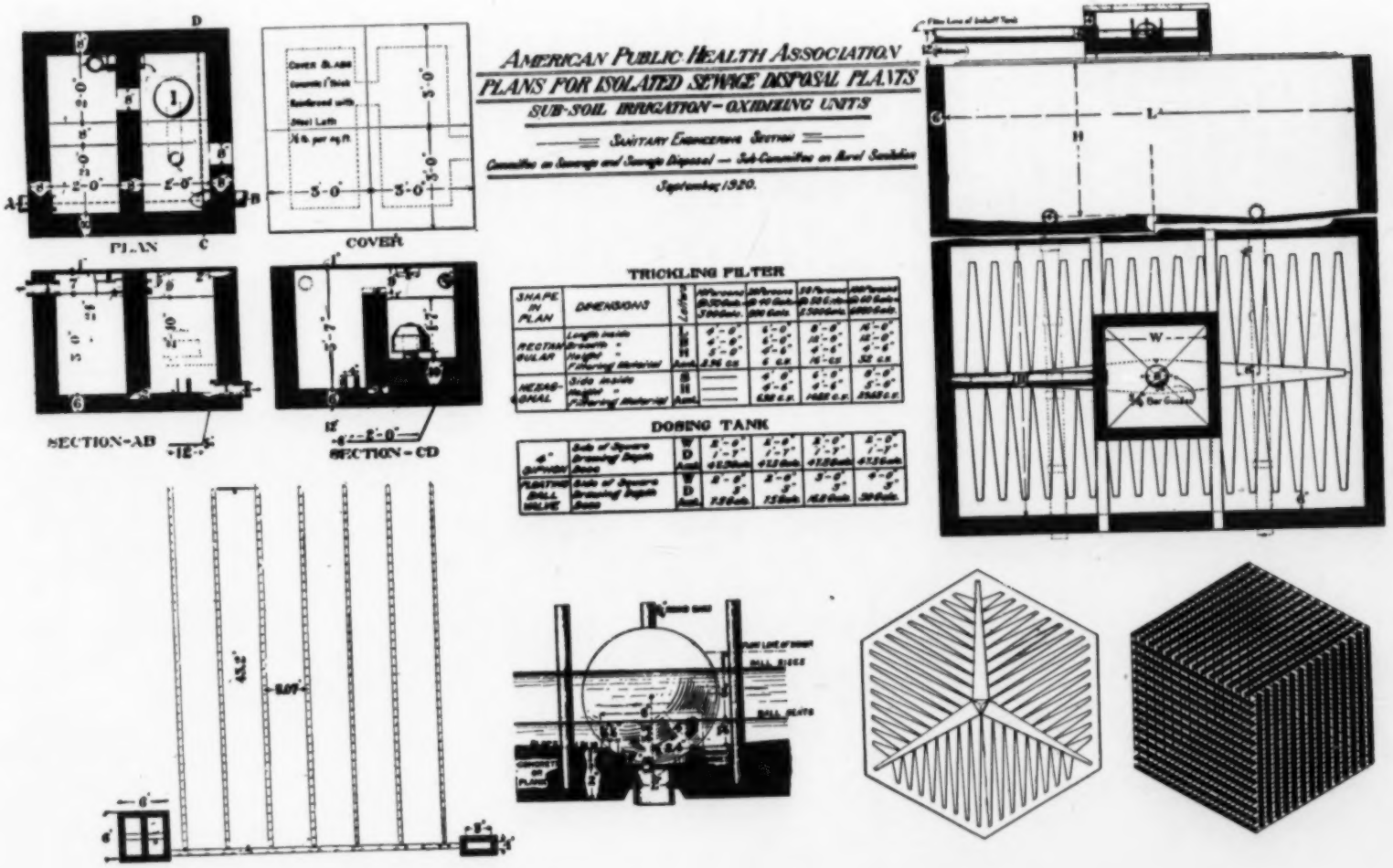
3. Drawings. Two drawings are submitted.
A. Plate I—Exhibits plans of sedimentation units as follows:
   (a) Septic tank.
   (b) Biolitic tank.
   (c) Imhoff tank.
   A table exhibiting dimensions of four sizes of each unit corresponding with the table of dimensions given above is also incorporated on the drawing.

B. Plate II. Page 555. Exhibits:
   (a) A compact plant for fifteen persons which has been repeatedly constructed. It contains settling chambers for grit and sludge, a siphon chamber and a discharge chamber. It discharges into a subsoil irrigation system.
   (b) Trickling filters, both rectangular and hexagonal in plan, together with table of dimensions.
   (c) Dosing device for trickling filter.

4. Sedimentation and Digestion Units.
A. The type of tank to be selected may be governed by cost or other conditions as follows:
   The Septic tank is cheapest to construct.
   The Biolitic tank will yield less sludge to handle and
   The Imhoff tank will produce the clearest effluent and the least offensive sludge which can be most conveniently removed without interfering with the operation of the tank.

B. Construction.
   (a) The material may be concrete as shown on the drawings, Plate I, or wood may be employed with earth banked against the sides.
   (b) The sloping bottom planks of Imhoff settling chambers should be built of planed lumber, down the upper surface of which sedimented solids will slide unassisted, and up beneath which gas bubbles will rise freely without being trapped.
   (c) Protection against frost should be furnished by providing board covers which will also prevent objects other than sewage from getting into the tanks. Covers should not, however, be air tight.
   (d) Dimensions are shown for four sizes of each type of tank in a table on Plate I.
   (e) The location of the tank should, if possible, be at least 100 feet from the nearest dwelling and all openings to the tank should be screened.

C. Operation.
   (a) In warm climates it may be necessary to raise the sides and ends of the gas vent of the Imhoff tank to prevent boiling over into the settling chamber, but by keeping the upper surface of the sludge some distance below the slots and by removing scum before it becomes heavy, this will, in general, be unnecessary.
   (b) Sludge should be removed from Septic tanks and from the settling chamber of Biolitic tanks when it nears the limit of 1 cu. ft. per capita. This may be once or twice a year. The tank will have to be temporarily out of service during cleaning. The Imhoff tank may operate uninterruptedly during the drawing of sludge which should occur several times during warm weather. A considerable quantity, about ½ cu. ft. per head, should be left in the tank after


AMERICAN PUBLIC HEALTH ASSOCIATION
PLANS FOR ISOLATED SEWAGE DISPOSAL PLANTS
SUB-SOIL IRRIGATION - OXIDIZING UNITS
SANITARY ENGINEERING SECTION
Committee on Sewerage and Sewage Disposal — Sub-Committee on Rural Sanitation
September 1920.
PLAN
COVER
SECTION-AB
SECTION-CD
TRICKLING FILTER
DOSING TANK

each drawing, and it should be drawn before its surface reaches the slots.

D. Design. The three types of tanks are illustrated on Plate I.

(a) The period of detention provided is 12 hours in both Septic and Biolitic tanks and 6 hours in the Imhoff tank. The latter figure is about double the best practice in large units. The period is lengthened on account of the relatively large momentary fluctuations of flow in a small system.

(b) Efficiency. The velocity through these tanks is but a fraction of an inch per minute so that the sedimentation will approximate that of a quiescent liquid.

5. Details of Dosing Devices.

A. (a) Whenever sufficient head is available a flushing siphon similar to that shown in the small plan on Plate II may be used. It has an average discharge of 0.65 cu. ft. sec. and no moving parts. It requires 2 ft. head from the flow line of the tank to the surface of a trickling filter if tapered board distributors are used. If a single sprinkler nozzle or a splash plate is used, an additional head of 6 ft. will be required for a filter for 100 persons. Sprinklers should not be considered for very small plants, as they are not apt to receive the necessary attention.

(b) Where head must be conserved, use a floating ball valve. Such a device has been found to operate satisfactorily for ten years without attention. It requires but one foot head from the flow line of the tank to the surface of the trickling filter if tapered board distributors are used. If a single nozzle or splash plate is used an additional head of 5 feet will be required for a filter for 100 persons.

This device consists of a ball 8 inches in diameter, preferably of hollow copper (wood, hollowed out and waterproofed will answer), weighing 3.30 pounds. It seats on a rubber gasket at the low level of the sewage in the dosing tank and rises from the seat and floats when the level of the sewage rises 3 in., thus discharging this 3-inch stratum from the dosing tank and an additional quantity equal to that which flows into the dosing tank during the discharge period. The amount of the dose thus depends upon the area of the dosing tank and the duration of the discharge, which latter is governed by the size of the orifice provided below the seat of the floating ball valve.

It is desirable to have the ball weighted to seat the same side down and to have it loosely guided so that it will find its seat promptly when the low level is reached. The piping is made up of stock fittings. This dosing device may be placed at one side or above the filter, as convenient.

B. (a) If there is sufficient head and a sprinkler nozzle is used, the Columbus type is preferred for summer use, and the Worcester type if the plant is operated in the winter. The Columbus nozzle tosses the spray high and secures ample contact with the air, whereas the bed will not freeze over the surface with frequent discharges from a Worcester nozzle with its flat trajectory.

(b) If a splash plate is used, suspend a 4-inch pipe around the falling stream to within 4 inches of the splash plate to prevent wind from deflecting the stream from the center of the plate.

(c) Least head will be required if in connection with the floating ball valve, tapered distributing boards are used. These boards should not be laid loosely on the filter as they are liable to warping and displacement. They should be mounted as a unit in

TABLE I

Population and Gals. per Day	10 People at 30 gals. = 300 gals.				20 People at 40 gals. = 800 gals.				50 People at 50 gals. = 2500 gals.				100 People at 60 gals. = 6000 gals.			
Character of Unit	Dimensions				Dimensions				Dimensions				Dimensions			
	l.	b.	h.*	Contents	l.	b.	h.*	Contents	l.	b.	h.*	Contents	l.	b.	h.*	Contents
1. SEDIMENTATION.																
A. Septic Tank	5′	2′	3′	30 c. f.	6′	3.5′	3.5′	73.5 cf.	10′	5′	4.33′	217 c. f.	12.5′	8′	5′	500 c. f.
B. Biolitic Tank																
(a) Agitation Chamber	2.5′	2.5′	3.33′	13.9 c. f.	3.5′	3.5′	4.5′	36.75 c. f.	5′	5′	6.67′	111 c. f.	6.75′	6.75′	9′	273 c. f.
(b) Settling Chamber	2.5′	2.5′	3.33′	20.8 c. f.	3.5′	3.5′	3.33′	40.8 c. f.	5′	5′	4.25′	106 c. f.	6.75′	6.75′	5.17′	235 c. f.
C. Imhoff Tank																
(a) Settling Chamber	5′	2x 1.23′	1.64′	10 c. f.	6′	2x 1.83′	2.44	27 c. f.	10′	2x 2.5′	3.33′	84 c. f.	12′	2x 3.54′	4.72′	200 c. f.
(b) Sludge Chamber	5′	4′	†3.31′	20 c. f.	6′	5′	†4.45′	40 c. f.	10′	6.25′	†5.60′	100 c. f.	12′	8.33′	†7.39′	200 c. f.
2. OXIDATION.																
D. Trickling Filter	4′	4′	5′	80 c. f.	6′	6′	4.5′	162 c. f.	6′ Side	Hexagon‡	4.5′	93 sq. ft. 400 c. f.	8′ Side	Hexagon	5′	166 sq. ft. 800 c. f.
E. Sand Filter	30′	30′	3′	900 sq. ft.	40′	40′	3′	1600 sq. ft.	60′	60′	3′	3600 sq. ft.	80′	80′	3′	6400 sq. ft.
F. Broad Irrigation	4356 sq. ft. =			0.10 Acre	8712 sq. ft. =			0.20 Acre	25000 sq. ft. =			0.52 Acre	60,000 sq. ft. =			1.38 Acre
G. Sub-soil Irrigation	200′ of 2″ Tile			1,000 sq. ft.	400′ of 2″ Tile			2,000 sq. ft.	1,000′ of 2″ Tile			5,000 sq. ft.	2,000′ of 3″ Tile			12,000 sq. ft.

*Bottom to water line.
†Flat Bottomed Tank.
‡8′x12′ Rectangle may be used.

a frame which can be leveled and centered.

Two general forms are suggested for square or rectangular and for hexagonal beds. In general, fasten the main distributing boards loosely to the lateral distributing boards and immediately above them. Raise the center of the whole system until the best position is reached as shown by a few trials. When once fixed there need be no further adjustment for the dose will always be of the same intensity.

Tapered board distributors consist of main distributors, two for rectangular and three for hexagonal beds, and lateral distributors. The number required is (3S — 2) for rectangular beds and 6S for hexagonal beds, where S is the side of rectangle or hexagon in feet. The thickness of the distributors need only be sufficient to prevent warping. The main distributors will be 12 inches wide at the center and 2 inches at the ends. They will reach to within six inches of the edge of the bed. The lateral distributors will be similar to those proposed by Frank and Rhynus of the U. S. P. H. S. They will be 8 inches wide, tapering to 2 inches with beveled edges and spaced 8 inches c. to c. They will reach to within 6 inches of the edge of the bed.

6. Trickling Filters.

A. Construction.

Filters may be constructed of broken stone, lath or brush from 4½ feet to 6 feet deep.

For a stone filter the bed, in plan, may be circular if it is to be dosed by a spray nozzle or a splash plate. If tapered boards are used, the rectangular plan is simplest. The hexagonal plan also lends itself to tapered board distribution and approximates the circle for spray or splash distribution. It also has an advantage shared by the rectangular form when lath or brush is used as filling of these materials can be regularly and uniformly spaced in each layer and crossed by that in the next succeeding layer as illustrated on Plate II.

(a) Stone filters. The finer the material which can be used without clogging, the more surface will be exposed and the better the efficiency. Clogging relates not only to obstructing the filter to the passage of liquid, but also to the passage of air.

Sound stone, which will not weather, of well shaped angular fragments, with all fine material excluded, will operate successfully with a well-clarified sewage, in sizes which will pass a 1½-inch screen and be retained on a ¾-inch screen.

If a sprinkler nozzle is used it should be supplied by 2-inch C. I. soil pipe from the dosing chamber.

Underdrains will be 4-inch vitrified tile laid with open joints on a 1 per cent grade about 6 feet c. to c. The bottom of the filter may be concrete or puddled clay sloped 2 inches toward the drains. The inverts of the tiles will be level with the valleys, and the ridges between drains will be level with their axes.

The side walls of filters may be of concrete, or if not too much above ground, plank sides may be constructed and banked with earth or dry rubble walls may be piled up if large stones are available.

(b) Lath filters. An attempt should be made, with this filling, to make the length and breadth of rectangular filters multiples of 4 for convenience in construction. Thus a filter for 50 persons at 50 gallons per capita daily might be 8 ft. x 12 ft. and 4.5 ft. deep. The lath can best be piled as suggested by Frank and Rhynus, 3 in. c. to c. in each

layer, and after crossing layer No. 1 with layer No. 2, the laths in layer No. 3 will be laid parallel to layer No. 1, but with the center of each lath directly over the center of the space between the laths in row No. 1.

A lath filter needs no walls except to protect from freezing.

(c) Brush filters. As brush can be cut to any desired length, any convenient dimensions may be used for either rectangular or hexagonal filters. In the square and hexagonal plan all brush for a filter will be uniform in length.

A loose pile of brush is useless, as it offers but little surface to the sewage. Brush should be tightly packed and laid in one direction in layers about 9 inches deep and should then be crossed by the next layer. A convenient way is to make up "fascines" (such as are described in the U. S. Army Engineers' Manual) of tightly bound bundles of straight brush with all leaves removed. The brush may run up to an extreme size of 2 inches at the butt. It should be laid in both directions so that the fascines, when compressed and tightly bound, will be uniformly about 9 inches in diameter.

After a layer of fascines is placed in the filter a second layer is placed transversely, after which the bindings of the lower layer are cut. To prevent the filter getting out of shape it may be held in position by stakes pinned through it with wire binding the outside of each layer to the stakes.

The brush filter is more efficient than lath, as in the latter there are broad surfaces of contact, while the brush touches only in lines and points, thus presenting more oxidizing surface to the sewage.

A brush filter needs no walls except to protect from freezing.

B. Operation.

(a) Trickling filters have been operated successfully at various rates depending upon size of stone, method of application and character of sewage. Brush filters in North Toronto originally constructed 5.5 ft. deep settled down to 4.5 ft. and still operated successfully. The rate was increased by steps from 2,000,000 gals. per acre daily in August, 1914, to 7,250,000 in December, 1916. At the same location slag filters produced about the same results on one-third the amount of sewage.

(b) Under rural conditions and assuming efficient preliminary sedimentation as specified herein, it is thought that with depths of 4 ft. to 6 ft. we should provide sufficient filter surface so as to apply not over 36 gallons per sq. ft. daily and a volume of filter material not less than 8 cu. ft. per capita. We may construct within these limits and still not increase the depth unduly.

(c) For a small plant it is not considered necessary to provide a final sedimentation basin following a trickling filter, for the solids which pass out with the effluent, if immediately diluted, are inoffensive.

7. Sub-Soil Irrigation.

A. Nomenclature.

Q = Gallons, total daily.
g = Gallons, per capita daily.
p = Persons contributing.
A = Area of tile field.
d = Inches, diameter of tile.
L = Length of tile per capita, feet.
S = Spacing between lines of tile, feet c. to c.
n = Number of discharges daily.

B. This method of disposal consists in the intermittent discharge of clarified liquid waste, equally through all parts of a system of subterranean leaching tiles, throughout a sufficient area of porous soil.

The organic matter is oxidized

much as it is in an artificial contact bed, but the water is removed both by downward percolation, and by surface evaporation after soaking laterally and upward by capillarity. When the area is planted, as it should be, moisture is also transpired from the plant surfaces.

The more open the soil and the more freely it drains, the more nearly it approaches the trickling filter in its action, with increased oxidizing capacity as compared to the contact bed.

As the level of saturation of the soil rises temporarily at each discharge and then subsides, some of the interstitial air is alternately exhaled and inhaled. Frequent doses are, therefore, desirable as long as the interval is sufficient for the lowering of the line of saturation to the level of the bottom of the tiles.

Character of soil. Soils are variously classified, depending upon size of grains and openness to drainage, as:

Gravel
Coarse sand
Medium sand
Fine sand
Very fine sand
Silt
Fine silt
Clay.

The effective sizes of grains run from 1.000 to .0001 mm. Soils containing much of the smaller sizes at the lower end of this list often have the maximum of total voids, but the coarser soils have more continuous channels of larger cross-section and hence water passes through them more readily.

C. Area of tile field.

Based upon the work of Schlicter, Mr. Robert E. Horton has prepared a diagram published in the "Michigan Engineer," 1906, showing daily amount of downward infiltration in inches depth on surface, based upon effective diameter of grains and percentage of voids.

Using a size of grain corresponding to "very fine sand" or "silt," 0.055 mm. and a very conservative percentage of voids (only 40 to 50 per cent of the average), viz., 20 per cent, the above mentioned diagram gives a daily downward infiltration corresponding to 4-in. depth on the surface. If we assume a factor of safety of 5 and thus use 8/10 in. of water daily we arrive at a limit of $8/10 \times 144 \div 231 = \frac{1}{2}$ gallon per square foot, which is the factor used. One-half gallon per sq. ft. at 50 gallons per capita daily corresponds to 100 sq. ft. per capita. For a smaller per capita volume and correspondingly stronger sewage, increase the area per gallon by basing it upon 100 sq. ft. per capita. Thus we arrive at the first Rule (a) *Area of Tile Field*: Not less than 100 sq. ft. per capita. Nor less than 2 sq. ft. per gallon, daily.

D. Length of tile.

Area being fixed, length and spacing of tile are interdependent for $A = p\,L\,S$. We may assume that the liquid and colloidal organic matter permeates the entire area of the tile field for a greater or less depth, but solids which may be carried into the tile will move but a short distance away from the tile joints and be filtered out from the liquid which passes on by capillarity through the soil. We may assume that the suspended solids which are carried over into the tiles will not amount to more than 100 p.p.m. About $\frac{1}{3}$ of these will be inorganic and about $\frac{2}{3}$ will be organic and will be partially taken up by vegetation or dissipated in the soil. At a specific gravity of 1.5 this becomes

$$\frac{50 \text{ gals.} \times 100 \times 231}{1{,}000{,}000 \times 1.5} = 0.77 \text{ cu. in. per capita daily.}$$

This material will be very fine and may, to some extent, be washed away from the joints into the earth by the flowing sewage, but neglecting this action and assuming that it fills the voids in the soil adjacent to the tile for a radius of 6 inches and assuming again that the voids amount to 20 per cent we will have a cylinder 12 inches in diameter 12 inches long surrounding each joint, from which must be

taken the volume of the tile. For a 2-inch tile ½-inch thick the volume of voids in the hypothetical cylinder of earth will be

$$12 \times 3.1416(6^2 - 1\tfrac{1}{2}^2) \times .20 = 255 \text{ cu. in.}$$
$$255 \div 0.77 = 331 \text{ days}$$

per capita per joint. Applying a factor of safety of 3 we have 110.3 days per capita per joint. 6 years = 2,192 days. 2,192 ÷ 110.3 = 19.8. Hence use a length of tile of 20 feet per capita and it may be expected that the plant will operate on the above basis for about 6 years.

If again we assume that the inorganic solids gradually collect in the tile and that the limit is reached when the tile is half filled, we have the following: Volume of 2-inch tile 20 feet long half full = $3.1416 \times 10 \times 12 = 377$ cu. in.

$$377 \div \frac{50 \times 231 \times 100}{3 \times 1.5 \times 1{,}000{,}000} = 1{,}469 \text{ days}$$

or 4.02 years.

E. Grade of tile.

An efficient system operates equally from every joint, covering the entire area. A small drizzling flow will seek the lowest joint and, at best, discharge from but few; therefore provide a flushing siphon and make each discharge equal to the capacity of the distributing tile. This is important and often, when overlooked, the result is failure.

The time of filling the drains is short compared with the time of emptying, hence the discharge from the tile joints is under hydrostatic conditions.

In order to make the flow from all points equal, the head must be the same over the whole system, hence lay the tile level.

Any collection of sediment in the tile would be apt to be carried on and piled up and the tile eventually plugged if operated under great velocity and high head.

For the longest system contemplated in this report 20 lines of tile 100 feet long will suffice and will readily fill from a common header. Five feet of 4-inch header will hold a volume equal to 20 feet of 2-inch tile. Five-inch and 6-inch headers respectively will fill 31.25 ft. and 45 ft. of 2-inch tile.

F. Laying tile.

After excavating the trenches with a drainage spade, lay in the bottom strips of board 3-inches wide and level them. On these boards lay the tile, wrapping each joint with a strip of burlap to prevent the entrance of earth. The joints should be left open about ¼-inch and the end of the terminal tile of each line plugged. Use always, unglazed drainage tiles one foot long. The header will be made of vitrified tile laid with tight joints, with the first length of drainage tile of each line tightly jointed in the side opening of a T-branch. Operating under very low head the soil may take up the entire discharge by capillarity.

G. Spacing of tiles.

Having obtained the area and length of tile the spacing between lines of tile is determined as follows:

$$S = A \div pL \text{ where } L = 20.$$
$$S = A \div 20p.$$

By the first rule, above mentioned, A must be not less than 100 sq. ft. per capita = 100p, nor less than 2 sq. ft. per gallon daily = 2pg. Using these values of A, we have as limiting minimum values:

$$S = 100p \div 20p = 5$$
$$S = 2pg \div 20p = g \div 10.$$

H. Size of tile and number of discharges daily.

With this area, length and spacing determined, we now come to the size of tile.

The area is based mainly on the amount of liquid handled.

The length of tile, upon the population contributing.

The amount of each discharge has been specified as equal to the capacity of all the tiles.

Hence this capacity equals the total daily flow divided by the number of discharges per day, or algebraically as follows:

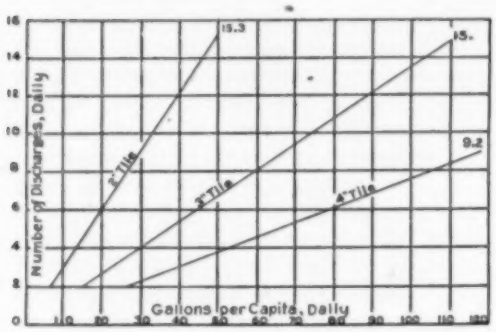
$$Q \div n = (3.1416d^2 \times 12 \times 20p) \div (4 \times 231)$$

whence $d^2 = (4 \times 231Q) \div 3.1416 \times 12 \times 20np = g \div .816n$

hence $d = 1.11 \sqrt{g \div n}$ and $n = g \div .816d^2$.

For d = 2 in. n = g ÷ 3.264
" d = 3 in. n = g ÷ 7.344
" d = 4 in. n = g ÷ 13.056.

Plotting the values of n for various values of g in the last three equations we have three lines for d = 2 in., 3 in., 4 in.



We note that 9.2 discharges daily will not be exceeded in 4-in. tile until the per capita flow is over 120 gals. daily. That 3-in. tile with 15 discharges will carry 110 gallons per capita daily and that 2-in. tile does not discharge more than 15.3 times for 50 gallons per capita, daily. With a 2-in. tile the daily limit of ½ gallon per square foot will fill 3.06 feet of the tile and at the prescribed spacing of 5 feet we have $5 \times 3.06 = 15.3$ discharges daily. Evidently the smaller diameter of tile is cheaper, as is also the smaller siphon chamber. If we consider that about one-half the daily flow is concentrated in 8 busy hours, and if we limit the discharges during this period to one per hour, we shall have 16 in 24 hours. This may be taken as the limit and will confine most rural plants to 2-in. tile. It will be noted from the diagram that 3-in. tile will not exceed 11 doses per day at 80 gallons per capita per day.

Thus we arrive at the second rule.

(b) *Tile Distributors.*

a. Length 20 feet per capita.

b. Spacing, gallons per capita ÷ 10, but not less than 5 ft.

c. Diameter 2 in. up to 50 gallons per capita and 16 discharges daily; 3 in. above 50 gallons per capita, daily.

From which follows the third rule.

(c) *Number of discharges* per day = daily flow ÷ contents of tile, but not over 16.

It will be noted that this system depends upon the porosity of the soil and its drainability. If it is very open, a smaller area might be used and the length of tile per capita reduced proportionally. The diameter and capacity, however, are dependent upon the number of discharges per day. A larger tile will hold a larger deposit of solids before it is choked, but we should provide efficient sedimentation in advance and remember that it may be necessary to relay the tile at intervals of four to six years, although there are cases where a system has operated successfully for 12 years.

I. Complete plant for fifteen persons.

A small plant, illustrated on Plate II, has been installed repeatedly with success. It will handle the sewage of 15 persons or 750 gallons per day. The tank is constructed of brick so that no concrete forms are required.

The system consists of:

(a) A brick structure 6 feet square outside with 8-in. walls and partitions, making four chambers, each 2 feet square. The first receives the sewage and retains most of the grit. Sewage then overflows into the second, in which the sludge collects. Scum collects in both first and second. The third is a siphon chamber drawing 19 inches depth and the last is a discharge chamber which connects with a tile field.

(b) The distribution consists of a 4-inch header of V. T. and 294 lengths of 2-inch farm tile laid in seven lines 5.07 feet. c. to c. The header consists of fourteen 2-ft. lengths of 4-in. tile and seven 4 in. x 3 in. Tees, each 12½ in. long. There will be 20 joints at ± ⅛ in., making the header 35 ft. 6 in. from the inside of the wall of the discharge chamber to the inside of a manhole at the other end. The header should be laid straight so

that it can be looked through by the aid of two mirrors.

(c) This plant conforms to the rules laid down in II-1-g, viz:

a. Area = 1,500 sq. ft.
Quantity = 750 gals. daily.

b. Tile 300 ft. 5.07 ft. c. to c. 2-inch diameter.

c. Number of discharges daily not over 15.5.

(d) Cost. The material required, at present prices, including freight and haul, will cost about $170.00. It consists of the following:

2,800 bricks.
38 bags of Portland cement.
2 cu. yds. sand.
1.1 cu. yd. broken stone or screened gravel.
48 sq. ft. or 24 lbs. steel lath.
294 — 2 in. farm tile 12 in. long.
15 — 4 in. V. T. sewer pipe 24 inches long.
7 — 4 in. x 3 in. V. T. Tees, 12½ in. long.
1 — 4 in. T-Y, C. I. soil pipe 24 in. long.
1 — 4 in. soil pipe nipple 12 in. long.
1 — 4 in. Miller Siphon, "Special Design," for sewage.

III.

RECOMMENDATIONS

Where an effluent stream is available, the above methods of treatment will satisfy the reasonable requirements of local authorities. Where land treatment is indicated, the subsoil irrigation method is simple, adaptable and inexpensive. If intelligently installed, it will operate with a minimum of attention.

For any of the systems described, a grease trap on the kitchen drain, before it reaches the sewer carrying closet waste, will be advisable for, if discharged into a stream, grease is unsightly on the surface and if land treatment is adopted, the soil will not clog so quickly if grease is previously removed. A grease trap should be of size sufficient to hold the largest momentary discharge, for its object is to retain the liquid long enough for it to cool and allow the grease to separate and rise to the surface. The inlet pipe should be below the surface and the outlet riser should reach close to the bottom which should be hopper-form.

Care should be taken not to admit into the system matches, fruit rinds and other garbage or solid objects. No paper which will not quickly mascerate should be used as the object is to exclude from both sludge and scum any materials of fibre or fabric which would otherwise accumulate and require frequent hand removal.

Tanks which depend upon biological processes for the digestion of sludge may need attention until the proper action has become established. This is particularly true of the Imhoff tank which is best started by "seeding" with sludge from an older plant. A little milk of lime introduced into the gas vent will correct acidity which may develop at the start. Attention for a short time and the removal of heavy accumulations of scum will, in general, start a tank satisfactorily.

In the plans submitted, as little fall as possible has been required of the sewage. Where sufficient head is not available sewage can be pumped from a small discharge chamber following the tank, into the Dosing tank. For this purpose any available power may be used. For large installations, the pneumatic ejector is particularly satisfactory.

IV.

CONCLUSION

As last year's report of the Committee on Sewerage and Sewage Disposal dealt with rural conditions in general, and as the committee's work this year is covering enlarged activities in other lines, it was thought fitting to supplement the former report by a more extended discussion, limited to the disposal of water-carried sewage in rural communities.

With this object the above report is presented by the Sub-Committee on Rural Sanitation.

JOHN F. SKINNER, Chairman.
HENRY N. OGDEN,
JOHN C. DIGGS.

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DISCUSSION ON RURAL SANITATION

The following communications followed the reading of the foregoing reports at the session of the Sanitary Engineering Section, American Public Health Association, at San Francisco, Cal., September 15, 1920.

PRIVIES AND SEWAGE DISPOSAL FOR FARMS

WILLIAM PAUL GERHARD, DR. ENG., SANITARY ENGINEER,
New York City

[In his introduction Dr. Gerhard referred to conditions in the country including a mention that in a southern state 40.2 per cent of farm houses with white tenants and 83.3 per cent of those with negro occupants were without privies and a further statement of the small ratio of farmhouses in general with water piped into the house. Since not only the farmer himself is dependent upon the farm for food supplies, but large urban communities, the sanitation of the farm is very important. Insanitary conditions on the farm may mean a health menace to the distant city. Taking the discussion at this point Dr. Gerhard's own text follows.]

I am convinced that the single vital improvement of running water should always stand at the head of the list of desirable utilities. Its introduction is usually rapidly followed by the installation of a modern kitchen, laundry and bathroom plumbing equipment, including, of course, a boiler for hot-water supply. But all this, in turn, as soon as made available, requires a second sanitary system, namely, a safe disposal of the liquid wastes and of the excreta, where water closets are introduced. It is in this particular where the laws of health are often violated. Indeed, there are to be found today on improved farms but few examples of model, or even tolerably safe, sanitary waste disposal systems. For the farmer, as a rule, has been indifferent to the need of an adequate sanitary system of disposing of the accumulation of organic refuse, be it in the house, or in the barn, the stable, or the manure heap.

This state of affairs is all the more surprising because there is certainly no lack of sound information on the subject. Nearly every state board of health has, in recent years, issued useful, and in many cases practical, bulletins on the subject, and the many contributions of the United States Public Health Service, of the United States Geological Survey, and of the U. S. Department of Agriculture are too well known to engineers and health officers to necessitate more than a passing mention.

It is perhaps to be regretted that a good many health bulletins contain, along with

sound recommendations, some advice which, to say the least, appears to be of questionable value. I refer in particular to the recommendations of so-called "sanitary privies." Among a score or so of bulletins before me, many of which are listed in the biblography attached to the Report of the Sewage Disposal Committee, published in November, 1919, in the *American Journal of Public Health*, I can find but few, which do not suggest, or even urge, as a solution of the problem, on those farms where the water-carriage system of plumbing has not yet been introduced, the use of so-called pit privies. These pit privies, styled "sanitary," which they are NOT, are to take the place of the common, objectionable, dangerous and always foul open or surface privies, which pollute the soil and frequently the water in farm wells, and are, therefore, always a menace to health. To my mind the pit privy is a most primitive device, embodying dangerous, because insanitary, features. The only possible good point which may be claimed for it is that it provides a protected place for the deposit and retention of human excreta. An improved construction of the outhouse and its seat render these inaccessible to men's feet, or to the washings from the rain, or to the spread by domestic animals and fowls; they are also protected from flies. In all other respects a pit privy represents an unsafe and undesirable large accumulation of organic matter in a slow process of decomposition or putrefaction. It is, moreover, unsafe because the fluid leachings from it diffuse themselves in the ground and eventually may reach distant wells or springs on neighboring farms or estates. In some geological formations a pit privy is as much of a danger as is the leaching cesspool.

When such a pit has become nearly full, the farmer is advised to fill it up, to cover it with soil, to dig a new pit nearby and to move the privy house over it. It is quite true that in this way the farmer avoids the somewhat objectionable handling of the waste matters which are, for instance, required in the vault privy. But the very cautions recommended in the use of a pit privy, namely, that it should be placed not less than 150 feet (some bulletins say 200 or more) from the well or other source of water supply are, aside from the other reasons mentioned, in my judgment, sufficient to condemn it. For, as a rule, the farm well is located near the farm house, for convenience's sake, hence, if the privy is to be 150 or more feet away from it, its use becomes difficult in stormy weather or at night time, and postponement to go leads to well-known bodily ailments. The advice of filling up a pit and providing a new one close by, ultimately must lead to a pernicious multiplication of insanitary conditions. Besides, it would seem to me that the filling of the used pit, the digging of a new one, and the repeated removal of the bulky superstructure are bound to cause the farmer more labor and trouble than the simple removal, on a wheelbarrow, of cans, pails or boxes, of the better systems.*

Unprotected receptacle privies and open so-called "sunshine" privies are likewise to be shunned.

The fly-proof vault privy, having a shallow water-tight cemented vault, from which there is no seepage, with well-rounded bottom to facilitate cleaning operations, with tightly-fitting doors giving access to the vault in the rear for cleaning, is somewhat better than the condemned pit privy, but the frequent removal of its contents, necessitated by its shallow depth, is not a job relished by the average farmer.

The importance of the subject must be my excuse for having dealt with it somewhat in detail. Not wishing to appear as indulging in merely destructive criticism, I desire to say a few words about methods of disposal which are really sanitary. Speaking generally, such systems may be divided into dry disposal systems, liquefying or biological systems, chemical systems and finally the water-carriage system.

Of the approved dry systems, mention should first be made of the well-known earth-closet system. This is not at all a new device, for

*After the completion of this discussion the writer received from the U. S. Public Health Service a copy of a "Supplement" to *Public Health Report* of June 18, 1915, entitled, "Resolutions Concerning Disposal of Human Excreta at Unsewered Homes."

These resolutions were adopted in Washington, May 18th, 1915, at a Conference of State and Territorial Authorities. Paragraphs 6, 7, 8 and 9 condemn pit privies and read as follows:

6. "That in advocating privies for use in the disposal of human excreta not only proper construction, but also proper upkeep and proper use of the same, and proper disposal of contents should be urged.

7. "That in general the only types of privy to be recommended as sanitary are those provided with watertight receptacles to receive the excreta, and so constructed that flies cannot have access to the excreta.

8. "That the construction and use of privies such as fly-proof surface privies, unscreened receptacle privies, and the so-called 'pit privies' which may be improvements over existing privies in certain localities, but which can be made to serve the purpose of sanitary privies only under certain conditions of location, season and soil formation, should be suggested only as compromises and with a full presentation of their attendant dangers.

9. "That the so-called 'pit privies' are especially unsuited for use in sections having limestone or marshy soil formation."

the late well-known sanitary engineer, Col. Geo. E. Waring, Jr., became one of its early champions almost fifty years ago. In England its use has been very general in the country districts, where it was found to constitute a perfectly satisfactory substitute for the common privy. Not its least advantage is that it can be attached directly to the dwelling, in a service wing, thereby avoiding the necessity of personal exposure in inclement weather. The U. S. Department of Agriculture recommended its use in 1896 in one of its well-known Farmers' Bulletins. The use of fine sifted and dried loam was advised, the finer the earth, the greater being its capacity for absorption. It is of interest that Dr. Theobald Smith pointed out in this bulletin the use made in parts of Europe of pulverized peat or "peatdust." He strongly recommended the use of peat because of its high absorbing power for liquids, and because it renders a closet practically odorless.

A properly built earth-closet consists of a substantial house, well protected from the weather, with door and windows and ventilators screened against flies, with a wooden or metal receptacle placed under the seat to receive the dejecta and tight-closing doors in the rear, giving access to the receptacle under the seat. By means of suitable handles the boxes can be readily removed when nearly full, to the garden or field, where their contents are emptied into a shallow trench and covered with soil, to which some lime may be added. The removal of the box should take place once a week or oftener, according to the size of the farmer's family. In the closet a box should be available containing dried pulverized earth and a scoop, with which the intelligent user should be admonished to cover the excreta.

The pail privy is really a fly-proof earth-closet, having instead of a wooden box receptacle, pails with handles, or galvanized ash or garbage cans. Such pails or cans are inexpensive, they are watertight, and can be easily removed, when nearly filled, without soiling the hands. Their contents may be spread in shallow trenches, where the top soil and natural bacterial agencies reduce all waste matters to harmless elements beneficial to vegetation.

Personally I cannot at all agree with the following statement, taken from a recent state board of health circular: "The pail privy is very useful under many conditions and when properly looked after, is safe. But the regular removal of its contents is such an unpleasant task that it is often neglected. Altogether, the pit privy is much more convenient."

In *Public Health Bulletin* No. 37, entitled "The Sanitary Privy," Dr. C. W. Stiles describes and illustrates several styles of pail privies, but carefully avoids mention of any pit or vault privies. In *Public Health Bulletin* No. 68, on "The safe disposal of human excreta at unsewered homes," there is corroboration of my views.

Considering the small initial cost, and the universally good results accomplished by the approved types, it is much to be deplored that comparatively few safe devices are found on American farms. My view is that a well-constructed privy of the receptacle type, properly screened from flies, well ventilated, properly enclosed and properly operated, i. e., used much like an earth-closet, constitutes the best available and most inexpensive sanitary privy. The important point about it is to arrange it so that it can be readily cleaned. The other types are but unsatisfactory makeshifts.

The L. R. S. style of privy belongs to the liquefying vault system, and consists of a concrete water-tight vault, into which some water is poured from time to time, and which is sometimes provided with baffles or partition walls. It is screened from flies, has a seat with tight lid placed over the vault, and has an overflow drain leading the surplus liquid to a tile disposal field. In such vaults the anaërobic bacteria perform a useful function, hence no solid or liquid disinfectants should be added to the contents, as these would kill germ life and retard, if not destroy, the expected liquefaction of the solid excreta. The effluent from such a liquid vault privy is not unlike that from a septic tank, it is not purified and requires further treatment by aërobic bacteria in a nitrifying trench or a system of aërated drain tiles, or a shallow filter bed filled with cinders, coke or gravel.

Such a device obviously requires intelligent use and some attention, and in the northern states it might give trouble from freezing. Several types are manufactured as a commercial article. In point of cost it is more expensive than an earth-closet or a pail privy, and many well-to-do farmers, who can afford its expense, would probably prefer going a step further and introducing a water-flushed indoor closet bowl.

Chemical closets have been introduced in recent years as a commercial article of manufacture. In some types the receptacle contain-

ing the excreta and the chemical is located directly under the seat. In others the seat is connected by a metal tube to an underground rust-proofed metal tank. The chemical used is a caustic liquid intended to sterilize, deodorize and liquefy the solid matters in the tank. Some types, which are in the nature of commodes, and which are intended for indoor use, have a neat appearance and finish. They undoubtedly merit some consideration, but the fact should not be overlooked that the chemical used destroys all bacterial action, and when the contents are emptied or withdrawn, extreme caution is necessary to dispose of them safely and without creating a nuisance.

Incinerator closets, such as suggested in a recent bulletin of the Texas State Board of Health, have some features recommending them for use where an infectious disease occurs. They consist of steel tank commodes, the contents of which are periodically destroyed by fire, without any removal being necessary.

One objection raised against all dry disposal systems is of some moment, i. e, that they require some intelligent supervision, and this, unless a farmer is disposed to exercise it himself, cannot always be relied upon. Hence, where farmers are either unwilling or unable to give the "sanitaries" periodical attention, it is unquestionably better for them in the end to introduce the indoor watercloset system, which is an ideal, though costly, arrangement. Its comfort and convenience are too well known to require at this day any further praise. But if the water-carriage system and modern plumbing are introduced, beware of committing the mistake of using the usual cesspool for the disposal of the liquids. The leaching cesspool always, and the water-tight cesspool at times, are abominations which must not be tolerated.

Kitchen and bath slop wastes, where a dry-closet is used, and the entire house sewage, where there is a complete plumbing system in the house, can be readily and safely disposed of, after treatment in a liquefying or septic tank, either by surface, sub-surface, or intermittent sand filtration.

The popular and widely disseminated idea that a septic or scum tank alone is sufficient to purify sewage so that it may be safely discharged into any ditch, or a stream or body of standing water, should be combated as entirely erroneous. The septic tank process is only a preliminary treatment, and its effluent being unclarified and foul-smelling, requires further treatment by nitrification or oxidation processes.

More or less complicated disposal devices, such as the Imhoff digesting tank, the contact filter beds, and trickling or sprinkling filters are not well adapted for use on the isolated farm. The available and approved systems have been often and well described. Mention should perhaps be made of the modification, suggested in a bulletin of the Iowa Engineering Experiment Station, on "Sewage Disposal for Village and Rural Houses," published in 1916, of having in connection with the scum or septic tank a small upward sand filter, and of the ingenious plan of a two-story aërobic pebble filter bed, following liquefaction in a septic tank.

Where permanent results and long-continued operation are desired, regardless of an increased initial cost of the system, excellent results have been obtained by me through the introduction between the scum tank and the liquid or dosing chamber of a "cultivation tank" with upward filtration. These were described and illustrated in one of my books, published in 1909.*

The more general use of small concrete slop-water basins for those farm houses which have kitchen plumbing but no water-closet, and the disposal of the kitchen slopwater by sub-surface absorption tiles laid in the garden or the orchard, should be urged as a simple and better method than the one usually practiced by the farmer's wife of emptying out the slops over the surface of the ground immediately about the dwelling.

In conclusion, the fact should be impressed on dwellers in rural districts that, no matter what the disposal of the sewage may be, a certain amount of care in management is required to keep such system in proper working order, and to prevent its becoming a menace to health.

*Gerhard: The Sanitation, Water Supply and Sewage Disposal of Country Houses, pp. 270, 271, 292 and 293. New York: D. Van Nostrand Company. Second Edition.

Note—To avoid misunderstandings it is, perhaps, fair to state that Dr. Gerhard's discussion, presented here somewhat condensed, was written by him without his having seen the report of the Sub-committee on Rural Sanitation. Dr. Gerhard's contemplated prolonged absence from the city compelled him to prepare his contribution to the discussion before the report could reach him.

SINGLE STORY SEPTIC TANK

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New York City

The time allotted me permits no comprehensive review of this compact and meaty report. I confine my comments therefore to one item—the simple, single-story septic tank. I have made this type of sedimentation and digestion unit a subject of special study and experiment for many years, and I believe that it is capable of better things than the report indicates. The drawing shows only its rudimentary form, a rectangular masonry structure, with a trapped inlet pipe, delivering vertically, and a similar trapped outlet pipe at the other end. The inlet pipe, confining the flow to a channel of small section, maintains high velocity, and the jet discharged from it, near the bottom, stirs up what sludge has settled during intervals of quiescence, and prevents the very thing we are trying to induce, undisturbed sedimentation. Moreover the point and direction of discharge leave practically stagnant, and subject to undue detention, the surface water at the inlet end of the tank, and induce special currents with velocity high as compared with that of a uniformly moving vertical cross-section of the whole contents.

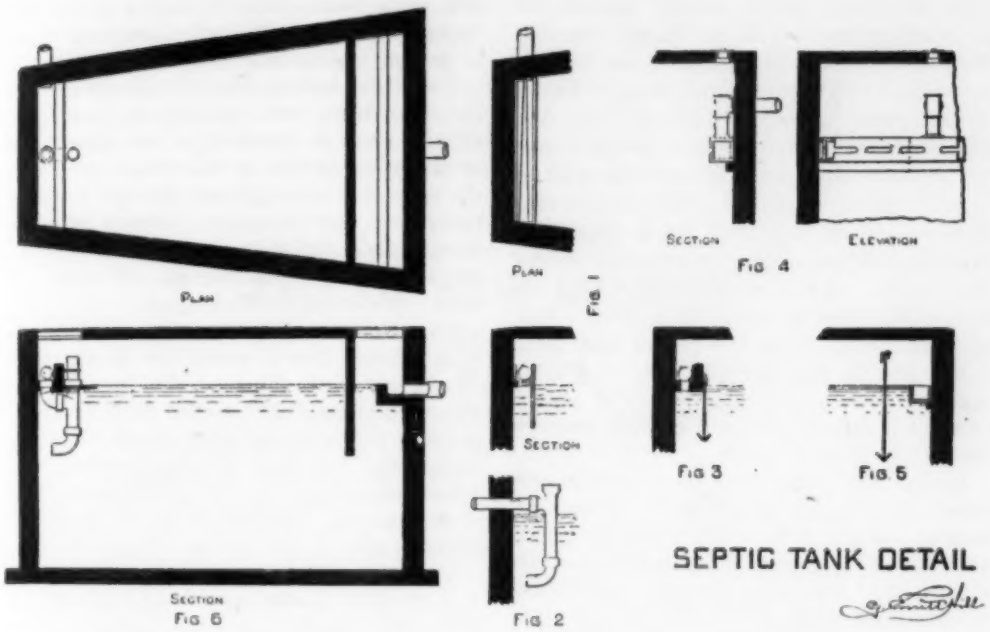
Much better than the pipe inlet, I have found the feed-trough of Figure 1 (made of wood if need be, but preferably of asbestos lumber), fed at one end, with a wedge-shaped opening in the floor, 2 inches wide at the inlet and 4 inches at the other end, flanked by a baffle to give a general downward direction to the heavier solids. The wide distribution of the inflow checks velocity and sludge is not seriously disturbed. A variant of this type is shown in Figure 3, where the trough is of concrete, and the baffle of wire glass, set in an angle-iron extending from wall to wall and held at the top by clips fastened to the trough. Occasionally grease accumulates under the troughs and interferes with normal distribution.

The best feed device I know is the reverting pipe inlet shown in Fig. 6, the result of a long series of experiments with inlets of various types, at different depths, in a glass tank filled with clear water and fed with colored water containing solids of varying sizes and specific gravities. This inlet delivers the flow horizontally against the rear wall of the tank, which acts as a diffusion plate, so that the liquid is spread almost uniformly over the whole vertical cross-section of the tank before it begins to travel to the outlet. Thus maximum displacement and minimum velocity are secured. (A good idea of the diffusion may be had by standing one foot from a vertical wall and blowing against it, at right angles, a gentle stream of cigar smoke.) Neither sludge nor scum is disturbed by the inflow. In tanks less than 5 feet wide at the inlet end, the simple type shown in Figure 2 may be used. In wider tanks multiple inlets, of the type shown in Figure 6, are desirable.

Experience indicates that in simple septic tanks diverging side-walls are preferable to parallel side-walls. In tests of the two types, side by side, equal in capacity and fed with sewage from the same source, the sedimentation efficiency of the straight-walled tank, was but 82% of that of the radial-walled tank. The reason is obvious. At the wide outlet end of the radial tank, the velocity is markedly lower than the mean velocity, which is the constant velocity of the rectangular tank. Light flocculent particles, which would be carried indefinitely by the mean velocity, settle and remain in the tank; and masses of sludge buoyed by gas, rising near the outlet end, have a better chance to settle again before the outflow point is reached. Moreover, in radial tanks, sludge digestion is more complete; but, as Kipling says, "that is another story," and too long to be told here.

A pipe outlet, like that shown in the drawing accompanying the report, inevitably induces an increase of velocity in the liquid approaching it, carrying forward again particles about to settle and entraining buoyed up sludge. Little of this flow comes from the corners of the outlet end of the tank, and the sewage there is over-detained.

Much better conditions are secured when the effluent escapes in a long thin sheet over a dead level weir-wall extending the whole width of the tank, as shown in Figure 6. Displacement is practically uniform from wall to wall, increase of velocity (until the weir is actually reached) is very slight, and the thin film of water passing over the weir is too shallow to float sludge-masses, which stop when they hit the wall and break up gradually.



escaping in such comminuted form that individual particles are not distinguishable.

Weir outlets must, of course, be protected by scum baffles. I have found wire-glass, held by angle-irons (See Figure 5) admirable for this purpose. It also makes excellent hopper-plates for Imhoff tanks.

Figure 4 shows a simple wooden outlet box, less good than the weir, but still accomplishing the withdrawal of effluent from the whole width of the tank. It is submerged with its slotted openings at the plane of greatest clarity. It needs no scum baffle.

I think it pays to provide a somewhat greater sludge-storage space than is usually allowed, and to clean less frequently. The shorter the interval between removals, the greater will be the percentage of undigested or partly digested matter to be handled. I have known a yearly cleaning to yield less than 70% of two semi-annual cleanings. Personally I think that the effective depth of a tank should be at least five and a half feet. Less than this either affords too little sludge storage space, or else brings the stratum of moving water too close to the supposedly quiescent strata of sludge and scum.

Is it advisable to include in paragraph B of Section I of the report a provision for chlorination of the effluent? Many of the state authorities are requiring this when potable streams are entered.

EFFLUENTS FROM SMALL IMHOFF TANKS CLOGDOSING DEVICES

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Alcoa, Tenn.

In selecting the type of settling tank to be used with small sewage disposal plants, various factors are considered. The writer's experience would indicate that, when the tank is to be used in connection with a subsequent oxidizing device, the type of tank should be selected with reference to the type of dosing device as well as to the usual considerations.

The effluent from an Imhoff tank treating fresh sewage is not septic and the growths produced by it will clog a small orifice, notch or pipe with such frequency that almost constant attendance is necessary to keep the devices working properly. This is especially true if the Imhoff effluent has an opportunity to absorb air before reaching the device.

In the Public Health Service experiments at Washington* two Imhoff tanks receiving fresh domestic sewage were used, one treating a strong and the other a weak sewage. Either of the effluents when run through a pipe line only partially full or through a dosing chamber covered all submerged surfaces with a layer of slime. This slime broke loose in sections resembling a piece
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*Reported in *Public Health*
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Communities," by Leslie C. F

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Director, Bureau

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To communities, state health bodies and laymen with some scientific training, the re-

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Firstly: Education in the necessity of some definite plan of sewerage.

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JERSEY
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Chemist, Glen Ridge.

MEXICO
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YORK
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Health Officer, Endicott.
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M. D., New York City.
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DAKOTA
, Mass.
D., Director, City Health Dept., Sioux Falls.

TEXAS

John Ritchie, Jr., Boston, Mass.
A. H. Flickwir, M. D., Health Officer, Houston.

VIRGINIA

John Ritchie, Jr., Boston, Mass.
Arlington County Health Dept., Clarendon.

MEXICO

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Jacobo Fajardo, Chief of Division, Philippine Health Service, Zamboanga.

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Prof. Samuel P. Prescott, Cambridge.
Charles E. Bell, student, 1647 Beacon St., Brookline.

MICHIGAN

E. G. Norman, M. D., Battle Creek.
M. S. Tarpinian, Detroit.
Emma Francis, Head of Nutrition Dept., Battle Creek Sanitarium, Battle Creek.

MISSOURI

C. P. Knight, P. A. Surgeon, U. S. P. H. S., Jefferson City.
Viola Russell, M. D., A. A. Surgeon, U. S. P. H. S., Jefferson City.

NEBRASKA

Prof. C. E. Turner, Cambridge, Mass.
Fred Marion Gregg, Teacher of Psychology and School Hygiene, University Place.

Are you planning to take a friend when you go to the Fifteenth Annual Meeting of the A. P. H. A. in New York City, November 14-18, 1921, and nominate him for membership?

In the Public Health Service experiments at Washington* two Imhoff tanks receiving fresh domestic sewage were used, one treating a strong and the other a weak sewage. Either of the effluents when run through a pipe line only partially full or through a dosing chamber covered all submerged surfaces with a layer of slime. This slime broke loose in sections resembling a piece of heavy cloth, both in appearance and ability to clog pipes, orifices and siphons. It was impossible to keep a ¼-inch orifice over a splash plate clean. This was fed directly from the Imhoff tank by a 2-inch pipe flowing partially full. A Taylor nozzle following a dosing tank and siphon would not operate properly through twenty-four hours without cleaning.

Similar difficulties with other dosing and distributing devices using small openings or notches led to the development of the tipper and tapered board distributors, which operated satisfactorily with both effluents. The Imhoff effluents were withdrawn through 2-inch pipes lower than the water levels of the tanks and discharged directly from the raised ends of the 2-inch pipes into the tippers. The absence of air in the pipes prevented them from clogging and while slime collected copiously on the tippers, its distribution was sufficiently even to prevent interference with their operation.

The writer believes that if the experiments had been made with a septic effluent from either a septic or biolitic tank, the splash plate or nozzle would have proved satisfactory and the tipper and tapered board distributor would never have been developed. Reports of other investigators working with septic effluents do not indicate any such clogging difficulties as were experienced in Washington.

The floating ball valve was not tried, but it is believed that it would not have proved satisfactory with either of the Imhoff effluents used in the Public Health Service experiments in that sheets of slime would have prevented the ball from seating properly and would have clogged the orifice beneath the ball if the opening was less than two inches in diameter.

These experiments would suggest that an Imhoff tank should not be used in connection with a splash plate, nozzle or floating ball valve unless daily attendance can be relied upon. If these dosing devices must be used, a septic or biolitic tank with a self-cleaning screen at the effluent end would prove more satisfactory under the usual conditions under which small plants are called upon to operate.

*Reported in *Public Health Bulletin* No. 101, "The Treatment of Sewage from Single Houses and Small Communities," by Leslie C. Frank and C. P. Rhynus.

REAL NEEDS OF RURAL COMMUNITIES

J. F. JACKSON

Director, Bureau of Sa[illegible]y Engineering, Com. State Dept. of Health

Whitneyville, Conn.

Difficulties in distinguishing between rural and urban sanitation are always present. At first thought, one would naturally conclude that limiting the report to water-carried wastes would fix the line of division, but when one endeavors to apply the recommendations to the problems local to each particular state, the variation soon becomes apparent.

In Connecticut, only 56 of the 168 towns have even a primitive sewerage system. Rural sanitation, excluding from the discussion, localities served by sanitary privies with either the vault or can system and institutions using chemical toilets, is related to such treatment as will permit of the discharge into a stream not used as a source of water or ice supply. Where such a stream is not available and where soil conditions are favorable, some form of sub-surface disposal is desirable. Except with well managed, private estates and institutions, any other than the simplest method of treatment is inadvisable. Proper attention is hard to get, and methods with mechanical equip ent often hold back necessary improvemen' in sanitary conditions. If we cannot, under present conditions, obtain proper operation of s[illegible] all septic or Imhoff tank units or plain sand filters, by communities where the number of the population warrants the assumption that the plant will receive some attention, what hope is there of efficient operation of methods of treatment such as sprinkling filters, where daily supervision, at least, is required?

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LIST OF NEW MEMBERS

Proposed for Election to the

A. P. H. A.

April 1 to April 30, 1921, inclusive.

Names of Sponsors are set in **Bold Face Type.**

Names of New Members are set in Light Face Type.

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John T. Black, M. D., Hartford.
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Harry H. Moore, U. S. P. H. S., Washington, D. C.

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John Ritchie, Jr., Boston, Mass.
John H. Mills, M. D., 907 17th Avenue, Tampa.

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John Ritchie, Jr., Boston, Mass.
A. E. Campbell, M. D., Supt. of Health, Springfield.

MAINE

John Ritchie, Jr., Boston, Mass.
Mrs. Howard R. Ives, Pres., Baby Hygiene and Child Welfare, Portland.

MARYLAND

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Albert J. Bossyns, M. D., Medical Examiner Baltimore and Ohio Railroad Company, Baltimore.

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Gertrude B. Knipp, Exec. Sec'y, American Child Hygiene Association, Baltimore.

R. A. Bolt, M. D., Baltimore.

Philip Van Ingen, M. D., New York City.
Harriet L. Leete, R. N., Field Dir., American Child Hygiene Association, Baltimore.

MASSACHUSETTS

S. H. Stone, Boston.
Horace Morison, Exec. Sec'y, Boston Health League, Boston.

Prof. Samuel P. Prescott, Cambridge.
Charles E. Bell, student, 1647 Beacon St., Brookline.

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NEW JERSEY

John Ritchie, Jr., Boston, Mass.
Richard C. Smith, Chemist, Glen Ridge.

NEW MEXICO

C. E. Waller, Santa Fe.
J. F. Docherty, Health Officer, Albuquerque.

NEW YORK

John A. Conway, M. D., Howell.
D. W. Hardy, M. D., Health Officer, Endicott.

A. W. Hedrich, Boston, Mass.
Mary M. Crawford, M. D., New York City.

John Ritchie, Jr., Boston, Mass.
Louise D. Larimore, M. D., New York City.

OHIO

John Ritchie, Jr., Boston, Mass.
L. Bigler, M. D., Gettysburg.

Prof. H. R. Eggleston, Marietta.
Mary E. Pape, Teacher of Biology, Marietta High School, Marietta.

Wanda Przyluska, R. N., Columbus.
Nancy Folsom, Home Demonstration Agent of Huron County, Norwalk.

John Ritchie, Jr., Boston, Mass.
F. R. Dow, M. D., Health Commissioner, St. Clairsville.

PENNSYLVANIA

A. W. Hedrich, Boston, Mass.
Sherman A. Everett, M. D., Physician and Surgeon, Freeland.

SOUTH DAKOTA

John Ritchie, Jr., Boston, Mass.
W. M. Barnes, M. D., Director, City Health Dept., Sioux Falls.

TEXAS

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EMPLOYMENT BUREAU

HELP WANTED

Help wanted announcements will be carried free in this column until further notice. Copy goes to the printer on the 10th of each month for publication on the 20th. Mail to Boston office as early as possible.

In answering keyed advertisements, please mail replies separately to editorial office in Boston, Mass. In replying give age, professional training, salary requirements, previous positions held and three or more references.

Wanted: By a local Red Cross chapter in New Jersey, a district public health nurse, salary to start $1,500, with early increase if satisfactory. Address 442, L. B. H., care of this JOURNAL, Boston address.

Wanted: Health Officer—an experienced man in Public Health administrative work. Must also be competent and willing to personally conduct Infant Welfare Clinics and Tuberculosis Clinics in connection with County and City Health Centers. The plan under which applicant is to work is a coöperative County-City Health Department located in a progressive northwestern city of 25,000 population, and a county population of 20,000, U. S. Public Health Servi[illegible] coöperating. Salary $5,000 per annum. An excellent opportunity for the right man. Position open August 15 or earlier. References including name, age, and past experience in Public Health work required. Address Dr. F. T. Foard, U. S. Public Health Service, Great Falls, Montana.

Wanted: Chief Food Inspector. Must be a veterinarian who is qualified to do meat and milk inspection. Salary $2,640 per annum. Apply to Dr. L. J. Roper, Director of Public Welfare, Portsmouth, Virginia.

Wanted: Laboratory Technician to work in a group in a southern city of 50,000. Six men in the group, and six associates. Clinic and hospital of 26 beds with operating pavilion, etc.; is owned and will be operated by this group when completed. Technician must be thoroughly capable in blood, cultures, and tissue work as well as routine. Salary in accord with capabilities. Address 445, P. M., care of this JOURNAL, Boston address.

POSITIONS WANTED

Positions wanted announcements will henceforth be carried in this column. The charge is $2 per insertion. Copy should be received at this office by the 10th of the month.

Physician trained in public health, in physical education and child hygiene, with an excellent experience as a practitioner, teacher, and research worker, would accept position with school or with an industrial institution. Salary would depend on time to be given to work. Address 155, R. M. D., care of this JOURNAL, Boston address.

Health Officer—Ten years' general medical practice with part-time health work, followed by three years' executive and administrative state health department work. At present student Harvard-Technology School for Public Health Officers, Class 1920-21. Available June 1st. Administrative work preferred. Address 154, H. E. H., care of this JOURNAL, Boston address.

Public Health Child Hygiene Director is available for the months of July and August, for organization, surveys, lectures, educational propaganda, supervision and all other forms of child hygiene programs. Energy, personality and wide experience in this field in several large cities, with state and city departments of health and educational, medical colleges and hospitals. At present Medical Director of Public Schools in city of 120,000. Full particulars or interview on request. Address 156, W. A. R., care of this JOURNAL, Boston address.

Wanted: University position. Eight years teaching experience in all phases of bacteriological work in state universities. Experienced in research work. Qualified in all branches of bacteriological work. Position with future desired. Minimum initial salary $3,000. Address 157, M. J. T., care of this JOURNAL, Boston address.

A physician, experienced in city and county public health work, administrative and clinical, with a working knowledge of sanitary engineering, now a field agent, U. S. P. H. S., will be open for engagement as city or city-county health officer August 15 or sooner. Can furnish references from state and federal authorities. Engagement with organization coöperating with U. S. P. H. S. preferred. Address 158, D. J. N., care of this JOURNAL, Boston address.

PUBLIC HEALTH NOTES

Abstracts by D. Greenberg, M. P. Horwood, James A. Tobey and Homer N. Calver.

Demonstration of the National Child Health Council.—Notice has already been published concerning the proposed demonstration by this council, and further preliminary facts have recently been made. It is intended to assist some American community of between 20,000 and 30,000 of population and the surrounding county in securing conditions as nearly ideal as possible for the development of its children.

The first step will be the selection of the community, in which the demonstration is to be continued during five years. The Council has not imposed any geographical limitations, but believes that the following qualifications on the part of the community will be essential for the success of the experiment.

The town or city should be in a county of about 60,000 of population, stable, of average age distribution, and without strikingly predominant racial stocks. There should be a normal percentage of the population engaged in manufacturing and in a variety of industries. The surrounding country should be agricultural. The town should be in a birth registration state, the health conditions should not be abnormally good or bad, the mortality of children should not be abnormal and the health administration should be reasonably good.

Clarence King, holding degrees from the Universities of Columbia and Wisconsin, is to be director of this novel health experiment.

The committee which will recommend the town to be chosen for the experiment consists of Dr. Richard A. Bolt of Baltimore, General Director of the American Child Hygiene Association; Miss Ella Phillips Crandall of New York, formerly Director of the National Organization for Public Health Nursing; Dr. Charles J. Hatfield, New York, Director, National Tuberculosis Association; Owen R. Lovejoy, New York, General Director, National Child Labor Committee; Miss Sally Lucas Jean, of New York, Director, Child Health Organization; Dr. Haven Emerson, former Health Commissioner of New York, and Dr. Donald B. Armstrong of Framingham, Mass. ✣

Heredity and Tuberculosis. — Dr. Raymond Pearl has published some suggestive figures dealing with the problem of infection and heredity in relation to tuberculosis. He has investigated 57 family histories, involving more than 5,000 blood relatives. In 38 cases the original subject of investigation was tuberculous, and in 19 cases non-tuberculous. Each group could be regarded as a random sample of the working-class population of Baltimore, the only differential factor in the selection being that in the one case the individual with whom a history started was tuberculous, and in the other case not. Five generations were studied with the following striking results. A tuberculous person, it was found, had nearly six times as many tuberculous blood relatives as a non-tuberculous person. In other words, 7 per cent of the blood relatives of a tuberculous person were themselves tuberculous, whereas this was the case with only 1.2 per cent for the non-tuberculous. Where there was no immediate tuberculous ancestry (parents and grandparents non-tuberculous) 7.4 per cent of the offspring were actively tuberculous. Nearly a quarter (22.2 per cent) of these tuberculous progeny were known to have lived for some time before developing the disease in close contact with cases of active tuberculosis. On the other hand, of the 92.6 per cent non-tuberculous offspring of non-tuberculous ancestry, only about one-tenth (11.2 per cent) had been in close contact with an active case. Thus twice as many of the tuberculous offspring of non-tuberculous ancestry had been in close contact with active tuberculosis, as had been the case with the non-tuberculous offspring of non-tuberculous ancestry. These figures stress the importance of infection. But, as Dr. Pearl points out, when one or both of the parents were actively tuberculous virtually three-fourths of their non-tuberculous offspring had been in just as close contact with active, open cases as their brothers and sisters who developed the disease. Dr. Pearl's figures show that familial contact with active, open cases is undoubtedly a factor in determining the incidence-rate of clinically active tuberculosis, but he thinks it equally obvious that such contact does certainly not account for the whole, and it probably accounts only for a

small part, of the increase in the incidence of the disease occurring as the amount of tuberculosis in the immediate direct ancestry increases.—R. Pearl, *Amer. Rev. of Tub.*, Nov., 1920, 688.—(*D. G.*)

✣

Segregation of School Children With Heart Disease.—The author in the present study gives a definite answer to the mooted question as to what can be accomplished by segregating children with cardiac disease in special classes. He compared a cardiac class of 24 children with a control group of cardiacs who came to the clinic. The results are really remarkable. All these children had in the past been compelled to spend from 2 weeks to 3 months during every school year either in bed or in the hospital. Of the 24 children in the cardiac school, 21 did not lose a single day, this being the first time in their entire school life that they were able to be continuously present. Of the control children, 8 had a good attendance record, 6 developed such marked decompensation that they had to be admitted to the hospital for an average stay of 8 weeks, and the remaining 10 were frequently compelled to stay at home with slight decompensation, attacks of rheumatism and tonsillitis. The weight records are interesting. Of the controls 5 showed an average loss of 7 pounds for the year; the other 19 gained an average of 2 pounds. In the cardiac class every child gained weight, the average increase being 9 pounds. The cardiac class, of course, had certain advantages which the control group lacked. The cases of mitral insufficiency and stenosis were transported to and from school by a bus while the controls had to walk. None of the cardiac class were allowed to go home for lunch, but received their meal at the school, the diet being selected by the supervisor. These children also had a rest period during the noon hour and cots and blankets were provided. In conclusion the author states that taking all things into consideration, the establishment of a special class for cardiac children has distinct advantages—the segregated cases attend school without any undue absences, the hospital days are proportionally less, the children develop better, their physical condition shows marked improvement, the weight curve being especially encouraging.—W. F. Bopp, *Archives of Pediatrics*, Feb., 1921, 86.—(*D. G.*)

Spleen Examination.—Over 1,200 school children, all boys attending school in Mitchell county, Ga., were examined in the spring of 1921, most of them during February. In 2.1% the spleen was positive, usually being just palpable, though in a few instances the enlargement reached one or two fingers' breath. Eight hundred and sixty-five white boys gave a percentage of 2% while 396 colored boys gave 2.5%. Blood examinations were also made in some cases, though not on the entire series. The parasite index was low. The authors point out that all of the schools examined are situated in a region where quinine treatment and quinine prophylaxis were conducted last summer. The principal object in making the spleen examination at the time chosen was to ascertain the minimum rate as a basis for comparison with the rate occurring at the height of the malaria season.—Barber and Coogle, *U. S. P. H. Reports*, Vol. 36, No. 14.

✣

Protection Against Syphilis.—The world needs to block the extension of syphilis and to vanquish the infectious germs wherever found. For this, Vernes suggests the use of his recently completed colorimetric scale by which precise measurement of the infection is possible. This means of measuring requires two conditions: precision on the part of the manipulators and speed of work to allow of the taking of a great number of serological observations in a minimum of time. The equipment necessary is not more difficult to realize than that of sterilization in surgery; moreover, it is economical, for there is nothing for public health purposes whose expense is better justified by the resulting economy of time and personnel. Thus equipped, the laboratory becomes the headquarters of treatment. The whole organization circles about the patient, carrying the graphic measure of his infection. This instills the patient with confidence and he is induced to return for future care and observation. Other requisites are: anxiety on the part of the attendant to spare the patient pain, to save time, and to take an interest in his moral well-being. Observations during the past ten years have shown that patients treated by this method which Vernes calls "syphilimetry," are not susceptible to new infection with syphilis and are sure of not transmitting it to their offspring.—Vernes. *Int. Jour. of Public Health*, Vol. II, No. 2.—(*A. N. T.*)

Archives of Dermatology and Syphilology for March, 1921, has an interesting and valuable article by Drs. Udo J. Wile and C. H. Marshall. It is the study of one thousand eight hundred and sixty-nine cases of syphilis in all stages. The routine lumbar punctures have been carried out upon these patients and the associated findings have been carefully studied. This number is about one-third of the total number of cases seen. They have been selected particularly with reference to correct diagnosis and have been accurately observed over a definite period of time.

As a result of this study the authors made the following conclusions:

1. The nervous system, if uninvolved as shown by the accepted criteria during the first months of infection, is seldom invaded later. A negative preliminary puncture followed by positive findings at a later date occurred in only three of several thousand cases punctured.

2. Of the several criteria indicating involvement, the increase of organic solids is found to be slightly higher than either the cell count or the Wassermann reaction, the relative value being indicated in the order just mentioned.

3. A considerable degree of cerebrospinal involvement may be present in the latent period of syphilis without manifesting any signs or symptoms.

4. Such asymptomatic cases may become symptomatic later, and a study of the colloidal gold curve in these cases is of some value in estimating the ultimate prognosis of the case.

5. Comparing the large number of cases of primary and secondary syphilis in which positive findings are found, with the relatively small percentage of late neurosyphilis as compared to total syphilitic incidence, we must conclude that a large number of early cases are in the nature of a miningeal roseola, which is transitory in its clinical aspects.

6. The interpretation of the lumbar puncture findings, particularly early in the incidence of the disease, constitutes a valuable guide in estimating the ultimate prognosis of the disease with regard to the integrity of the nervous system.—(*A. N. T.*)

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Newer Aspects of Some Nutritional Disorders.—Hess reviews current views on vitamins and their relation to nutritional disorders, especially scurvy and rickets. Speaking of the use of cod liver oil in the treatment of rickets, he says: "It is recognized as a drug which benefits nutrition, but the fact that it has unequaled value in the prevention and cure of rickets is hardly realized." It is possible to rid any locality of rickets by means of the use of cod liver oil. There are approximately 125,000 children in New York City between the ages of 3 and 15 months, the period of greatest susceptibility to rickets. If we estimate generally that the families of one-third to one-quarter of these children are unable to purchase cod liver oil, and if we agree that the development of rickets may be prevented by giving a teaspoonful three times a day, then, at the present cost, rickets could be practically abolished in this city by the expenditure of about $150,000 a year. This is merely one of many instances in which the community does not get the full benefit of medical knowledge. Studies of the deficiency diseases have served to illustrate in a most convincing manner the intimate relationship of nutrition to infection, and have led to attributing increased significance to the former. Indeed, the chief clinical importance of disorders of nutrition seems to be associated with the fact that they bring about an abnormal condition of the tissues which renders them more susceptible to the invasion of bacteria or their products. Veterinarians and farmers are well aware that faulty nutrition leads to fatal infections. This "nutritional-infectious" aspect has been convincingly illustrated on a large scale among the peoples of the Central Empires, who during the many years of the war suffered from various forms of malnutrition. The general impairment of health was most strikingly manifested both in adults and in children by the great spread of tuberculosis and its increased mortality.—A. F. Hess, *Jour. A. M. A.*, March 12, 1921—(*D. G.*)

✣

Many Child Deaths in Russia and Roumania.—According to information from the Lettish Red Cross, child mortality in Petrograd during the winter months has been the heaviest in the history of the city. In certain districts the proportion of child deaths has been nine deaths to every ten births. The conditions of malnutrition are largely responsible for the appalling death rate among infants.

Twenty children out of every hundred die in Roumania before reaching the age of one year and fifty per cent die before reaching five years, according to recent statistical reports.—(*J. A. T.*)

STATE HEALTH NOTES—LEGISLATION

France.—A bill providing measures intended to increase the birth rate and improve the health of French children was introduced on December 2, 1920, by a group of deputies, among them Prof. Pinard, famous for his infant welfare work. Generous benefits are provided during the last four months of pregnancy and the first year of the child's life, the benefits being higher if the mother nurses the child, and still higher if she is a widow or unmarried. During the time the benefits are being paid, the mother and child are to be under the supervision of an office for mother and infant protection, to be established in each commune. Welfare visitors will have supervision over every child from 1 to 3 years old, at which age the children enter the *école maternelle*, where the supervision is continued.

The bill also provides for daily cash benefits for every child over 1 and under 13 years of age who is motherless, or the child of a widow or unmarried mother.—*Journal Officiel, Doc. Parl. Ch. 1920*, No. 1730, pp. 347-356. *(J. A. T.)*

✣

Delaware.—The following health bills were passed during the last session of the Delaware Legislature:

1. Increasing the appropriation for child welfare work from $25,000 to $60,000.
2. Increasing the appropriation for the control of tuberculosis from $30,000 to $55,000.
3. Providing for the free distribution of diphtheria antitoxin and for free distribution of material for making the Schick Test and immunizing with toxin antitoxin.
4. Providing for the employment of a nurse to supervise and educate the midwives of the state.
5. Providing that a physician shall certify as to the cause of death in all Coroner cases.

No appropriations for health work were reduced.

✣

Florida.—The Florida State Board of Health has adopted a set of regulations governing the operation of swimming pools, which embodies the general principle of the legislative act of 1919 of the State. These regulations insist that the water in the pool shall have a sanitary quality acceptable to the State Board of Health. For flowing pools 400 gallons per person per day is the minimum. Fill and draw pools shall be emptied and thoroughly cleaned at least once each week. Such pools shall also be disinfected by an approved method daily between the cleansing periods. The capacity of pools is established by the regulation, as is the color of the water and the necessity for a light colored surface for the underwater portions of the pool, which must be smooth and easily cleansed. The floor shall not have a slope of more than one foot in fifteen, and depth of the diving stands and spring boards shall not be less than seven feet. The depth of the water must be marked frequently at intervals along the side of the end walls. The pool must be surrounded by a raised concrete curb at least two inches high and twelve inches wide, serving as a clean space and a check against floor drainage. All walks and areas surrounding the pool shall be at least five feet wide and sloped to properly located drains. Scum and overflow gutters shall be provided on all pools.

There are regulations with reference to dressing rooms, their arrangement with regard to the pool, the necessity for all persons taking a shower bath before entering the pool water, the entrance to be through the shower room. Further provisions are made with reference to sanitaries, drinking fountains, bathing suits, disinfectants. Persons having communicable diseases shall not be permitted to use any swimming pool.

✣

Illinois.—The State Department of Public Health has drafted and introduced into the legislature a bill that provides for the employment of full-time medical health officers by every county in the State. It is felt that for Illinois the county is the logical and most practical unit around which to build up an efficient local public health administration.

✣

Massachusetts.—The anti-vaccination bill permitting children to go to school without the necessity for giving evidences of successful vaccination, which was passed by the Senate, was defeated in the House by a vote of 100 to 21. The bill providing for physical training in the public schools has been greatly

limited in scope by being resolved into the mere addition of the words, "indoor and outdoor games and athletic exercises" to the law as it now stands relating to the subjects to be taught in the public schools.

✚

Minnesota.—The legislature has recently passed a bill authorizing the issue of a million dollars in bonds for enlarging Glen Lake (Hennepin County) Tuberculosis Sanatorium, to take care of 300 additional patients. This sum is to be devoted to construction, the equipment being cared for out of current taxation. Since the passage of the bill was assured plans are well in hand and include an infirmary for men and one for women to be the wings of a central administration building, a dining room and recreation building, a nurse's home, a building for the men employees, a physicians' building, a superintendent's residence and a new heat generating plant.

✚

Ohio.—The Administrative Reorganization bill, House bill No. 249, is of great importance to the health interests of the state. It was introduced February 24 by Mr. Dunn of Bowling Green, amended and reprinted March 16, and passed as an emergency measure the next day. The Senate received it March 21 and reported it amended to the House on April 1. The Senate passed the bill as an emergency measure April 7. It affects all departments of the state, creating nine major departments, the directors of which are to be appointed by the Governor and to serve at his pleasure.

Since it affects the health interests of the state the bill was vigorously opposed by the Ohio Public Health Federation, which was able to secure various amendments but was not able to omit the provision of appointment by the Governor.

The bill provides that it shall become a law on July 1, 1921, although the emergency clause would provide for its becoming a law immediately upon final passage. Such a law carries the power to undo all the constructive health work accomplished in Ohio during the past 35 years.

It is expected that suit will be brought in the Supreme Court to test the right of the legislature to make the bill an emergency measure and thus prevent a referendum on it.

With reference to chiropractors, before the convening of the 84th General Assembly the Ohio Public Health Association prepared and distributed a pamphlet fully covering the chiropractic situation as it exists in Ohio. On January 4, the initiated bill to establish a Chiropractic Board to examine and license practitioners of chiropractic was introduced and became known as H. B. No. 13. The House Committee on Public Health reported the bill on February 15th, with a recommendation that it be indefinitely postponed, and the House accepted the recommendation. A new bill was introduced in the Senate on March 15 by Senator Endley of Mansfield. The bill was referred to the Committee on Public Health where it was voted to indefinitely postpone action on the bill. On March 31st Senator Endley moved that the Committee on Public Health be relieved of the bill and that the bill be placed upon the Calendar for third reading. His motion was defeated. This probably ends the efforts of the chiropractors at this session of the legislature. The State Supreme Court is to hand down a decision on their legal status in Ohio under the Platt-Ellis law.

A number of attempts have been made this year to amend the Hughes-Griswold law by writing in the salary to be paid district health commissioners. No legislation ensued and none is likely to be passed this session.

Other health bills on the Ohio calendar are: To prevent pollution of waters in the State; to transfer some duties from Ohio Commission for the Blind to State Commissioner of Health; to provide for keeping a record of births and deaths in the probate court; to amend tuberculosis hospital law; to curb the spread of tuberculosis; to amend state sanatorium law; to extend benefits of workmen's compensation so as to include occupational diseases; to provide state supervisory control of public water supplies; to amend state sanatorium law.

✚

Oklahoma.—The eighth legislature, while in regular session, passed a law for the prevention of blindness from ophthalmia neonatorum with the "Religious objections" clause attached.

Tennessee.—The General Assembly of Tennessee has enacted a number of laws this season. One of these enables counties to establish county departments of health with full-time county health officers, sanitary inspectors, public health nurses and necessary clerical assistants. This law also provides that municipalities within counties establishing such departments may coöperate, so that one health department in a county may serve for the county and all the municipalities located within it.

Another law authorizes counties to appropriate money to be used in coöperation with the State Board of Health for the purpose of making demonstrations.

A venereal disease control law was passed April 9, 1921.

✣

Texas.—The 37th Legislature has passed a bill carrying an appropriation of $300,000 for the purpose of constructing and equipping a hospital in Texas for the care of negroes suffering from tuberculosis. Till now there has not been a single bed available for this purpose.

✣

Saskatchewan.—In this province of the Northwest regulations have recently been passed governing private hospitals, maternity homes, foundling homes and similar institutions. These regulations provide for thorough inspection by the Commissioner of Public Health, and also stipulates that all such institutions shall be licensed, after particulars regarding the nature of the building, person in charge, qualifications, etc., have been furnished.

✣

STATE HEALTH NOTES—GENERAL

England.—The International Union against Tuberculosis is to hold its conference in London, England, from Tuesday, July 26, till Thursday, July 28. This will be open to members of the International Union and to delegates from countries within the League of Nations and from the United States of America. It is expected that the opening address will be by the retiring President of the Union, M. Léon Bourgeois, President of the French Senate. He is to be succeeded by Professor Sir Robert Philip of the University of Edinburgh. The principal subjects proposed for discussion are: "Modes of Diffusion of Tuberculosis Through the Races of the World," to be opened by Professor Calmette, and "The Role of the Medical Profession in the Prevention of Tuberculosis. Professor Léon Bernard of the University of Paris is Secretary of the International Union. The meeting will be held under the auspices of the (English) National Association for the Prevention of Tuberculosis.

✣

National.—Women and Public Welfare.—The General Federation of Women's Clubs, of which Mrs. Thomas G. Winter of Minneapolis is President, has a department of Public Welfare under the chairmanship of Mrs. Elmer Blair of New York City. It is an ambitious program that the Federation's department issues in its suggestions to its three divisions, those of child welfare, health and industrial and social conditions.

Under the first division, that of child welfare, are three leading suggestions, public protection of maternity and infancy, universal child health, and abolition of child labor. In the matter of maternity care and infant welfare, the suggestions are made of a united position of women with reference to maternity legislation, and information with reference to best methods of establishing and administering child health centers, which will serve to lower the mortality rate of mothers and infants. With reference to children of school age, the weighing and measuring movement is to be supported, while the child in industry should be protected by laws placing the responsibility for such protection.

The slogan of the Division of Health of the Federation is, "A national department of health and a high moral standard, the same for men as for women." In this division are committees on tuberculosis, and for coöperation with the Women's Foundation for Health, some of the objects of which are a new constructive conception of health, the value of the health inventory and the campaign for correct health posture and for approved shoes. A committee on occupational therapy discusses in practical ways employment for the sick during convalescence, while that on public health nursing seeks to demonstrate still further the value of this very useful aid to health, to educate the public to the need for public health nurses and to secure definite official

recognition of the nurse. Two other committees are there in this great organization, one on social hygiene, coöperating with the great national agencies, and one on institutional relations.

✣

The U. S. Public Health Service has for several years been studying occupational diseases and hazards with the sole view of reducing them in the interest of both working man and employer. It has already succeeded in doing this for many of them. But many more remain to be studied; and to do this effectively periodic physical examinations of the workers are necessary.

Many manufacturers and workers already understand this and are glad to coöperate with the Service in making the plants safer and more healthful. Some manufacturers, however, are suspicious; they fear that the "radicals" are seeking to spy out something that will make trouble for them. Some workers, too, are suspicious; they fear that any defects discovered will be reported to their employers, and will lose them their jobs. Consequently one or both sides actively or passively resist inspection and physical examination, not realizing that undiscovered defects in either plant or man will surely lead sooner or later to serious trouble, for which plant or man must pay, the plant in money and the man too often in health or life.

✣

"The prevention and correction of mental defectiveness," says the U. S. Public Health Service, "is one of the great public health problems of today. Its influence is continually cropping out. For instance, recent studies have shown that feeble mindedness is an important factor in prostitution, and that a marked proportion of juvenile delinquency is traceable to some degree of mental deficiency in the offender."

A recent state-wide survey in Oregon shows that more than 75,000 men, women and children out of a total population of 783,000 are dependents, delinquents, or feeble minded, and that more than 500 school children out of a total enrolled school population of 32,500 are more or less mentally deficient. The latter fact is significant when it is remembered that the condition of the children of today is the best possible index to the condition of the community of tomorrow.

The Oregon figures are considerably lower than the average shown by the draft examination, indicating that they are certainly not higher than those that would be obtained in other states.

✣

The U. S. Children's Bureau recently coöperated with the University of North Carolina in the giving of a short course in Community Child Health in the School of Public Welfare. This course was conducted by Dr. Frances Sage Bradley.

✣

That fewer men lost their lives in metal-mine accidents in this country during 1919 than in any previous year, for which statistics have been compiled, is shown in a report just issued by the United States Bureau of Mines. The number of men killed was 468 as compared with 646 killed in 1918. The number of men injured was 31,506 as compared with 42,915 injured in 1918.

The fatality rate was the lowest on record for the metal mining industry in the United States, and the injury rate was lower than any year since 1914.

Copies of Technical Paper 286, *Metal-Mine Accidents During the Calendar Year 1919*, by William W. Adams, mine statistician, may be obtained by addressing the Director of the Bureau of Mines, Washington, D. C.

✣

Canal Zone.—In clearing a place to the east of Miraflores Locks, in the Canal Zone, the scrub of the jungle was found to contain many rats and several hundred were killed each day by the men making the clearing. The possibilities of introduction of plague have been considered by the Health Department, which is making examinations of the rats and requesting those who trap or kill rats to send them or their carcasses to the Health Department for examination.

A study of the cases of malaria in the Canal Zone shows a gratifying reduction in the incidence of the disease. In 1919 there were 2,114 cases against 1,221 in 1920. Anti-fly breeding measures are a part of the health program, and it is worthy of notice that the scarcity of flies in the Zone is frequently a subject of comment from visitors.

Colorado.—The Colorado Health Department announces an increased appropriation for all divisions of the department. The State Board is establishing a new laboratory.

✚

Illinois.—April 17-23 was set aside for Health Promotion Week throughout the state.

A recent epidemiological investigation made by the State Department of Public Health into a typhoid fever situation at Charleston disclosed two definite points of infection. Of the six cases of typhoid reported, one was traced directly to a carrier, two to an area infected with sewage, and the other three appeared to have been contracted out of town.

The victim of the carrier was a child whose mother had been down with typhoid five years before. A laboratory examination of feces from the mother showed her to be an active carrier although she apparently enjoyed good health.

The case history of two boys showed that previous to the typhoid incubation period they had used for a playground an area into which a private sewer from a nearby house emptied. Further investigation disclosed the presence of a convalescing typhoid patient in the house. The boys had dug trenches in the sewage-infected area while playing soldier. Evidence clearly established the playground as the point of infection.

During the investigation it was brought out that a woman with a typhoid fever history, who had never undergone proper examination subsequent to recovery to determine her status as a possible carrier, was dealing out milk to school children. While none of the six cases was traceable to this woman still the danger of handling milk (or any other food product) after recovery from typhoid and without examination, is apparent.

Illinois has just completed a state-wide survey of the health centers, of which there are 42 in the state, undertaken by the Division of Child Hygiene of the State Department of Health.

Records show that more than 6,000 prenatal, pre-school and infant cases have received attention through these Health Centers. The survey showed also that a goodly number of communities maintain public health nursing services where the regulation Health Center has not been established. The work in each instance, however, appears to be substantially the same.

A significant feature of two all-day teaching clinics on tuberculosis that were recently held at Anna and Chester, was the attendance of the superintendents and the teachers of the local public schools. In each instance the interest of the teachers was voluntary and at Anna the superintendent dismissed school at an early hour in order to facilitate the attendance. Those in charge of the clinics gave special talks on undernourished and tuberculous children, and called attention particularly to the value of early treatment in such cases. The clinics were held under the joint auspices of the local medical and tuberculosis societies, and were under the charge of officers from the Illinois Tuberculosis Association.

✚

Maine.—The executive quarters of the Maine State Board of Health have been removed to the State House although the laboratories and the various division offices remain in the old health building within the State Hospital Grounds, at considerable distance. The change is for the purpose of getting the heads of departments in closer touch one with another.

Dr. L. B. Bristol, State Health Commissioner, realizes that Maine is a vacation and health resort and is taking especial pains to have the conditions of living and the sanitation such as to justify the fame of the state. Some paragraphs from a recent article from his pen illustrate the appreciation of his department of the needs and requirements:

"As Maine waters are stocked with fish, so the entire state is stocked with health. Health hunting in Maine is a popular and profitable pastime.

"Maine entertained over 600,000 summer guests in 1919, receiving an income of approximately $30,000,000 from this source. Is it not reasonable to assume that as a state she is doing everything possible to promote and to conserve one of her chief sources of income?

"The filthy fly has been declared an outlaw in Maine. A recent decision by a justice of the supreme court upheld the action of a guest in refusing to pay his hotel bill because of too many flies in the dining room. This decision will have a wholesome effect on all hotel proprietors, and a bad

effect on all the flies and other pestiferous insects. Maine is one of the few states, if not the only one, to hale the fly into court and obtain judgment against him.

"The State Department of Health of Maine carries on each year a careful sanitary inspection of summer hotels and camps throughout the state, awarding certificates of approval to those places which comply with the rules and regulations of the Department. All public water supplies in the state are examined several times each year by the Department. The state is divided into eight health districts, each in charge of a full-time, trained, district health officer who is constantly on the watch for insanitary conditions and sources of disease. In addition there are more than 500 local health officers serving their respective communities."

✚

Michigan.—A census of the state's water supplies, requested by the U. S. Public Health Service, has just been completed by the Michigan Department of Health.

It reveals two things: First, that 75% of Michigan's population, or 2,934,592 people, are served with municipal water supplies; and second, that 16.4% of the population, or 588,500, plus a large percentage of the 916,805 using private wells, are drinking water that is not properly protected from contamination.

"With the industrial growth and increasing population of the state," reads the report, "contamination of Michigan's unusually abundant water supplies has also increased. That percentage of the citizens drinking unprotected municipal and private water supplies is in continual danger of water-borne epidemics, and a constant menace to communities supplied with pure water."

Municipal surface water supplies, drawn from rivers and lakes, serve 58.2% of the population, while water pumped from deep and shallow wells, designated as ground water, is furnished to 17.5% of the citizens.

Exactly 50% of the population, 1,833,611 people, now have drinking water that is chemically treated to render it safe, the census shows, while 341,881, or 9.3% are supplied with filtered water. Upon the completion of contemplated filter plants, and filter plants now building, an additional 1,322,880 people—33% of the population, will be drinking filtered water.

To correlate all health and allied work carried on by women's organizations in Michigan, directors and heads of 10 specialized state activities have consolidated there forming a committee to be known as the "Coöperative Public Health Council," whose function is to serve as a clearing house for interrelated problems.

"Contact with practically every woman throughout the state will be established by the Council," declares the Chairman, May Person, professor of nutrition at the Michigan Agricultural College. "This will mean," she writes, "the equivalent of reciprocal advantages from the various agencies and a multiplication of their power. Matters concerning one group of workers will be referred and systematically handled."

General physical examinations of school children, between now and the end of the school year, are urged by the public health authorities in order that dangerous remedial defects, and correctable physical conditions may be remedied during the summer vacation. Such a procedure, it is pointed out, will improve the health of communities and help raise next year's class ratings.

"Scarlet fever, diphtheria, and other diseases have been unusually prevalent in nearly every part of the state; many children have lost time from school on account of sickness which may have left marks affecting the health of those that apparently recovered; and the lowered physical resistance of thousands of children has rendered them peculiarly susceptible to tuberculosis," according to Dr. R. M. Olin, Commissioner of Health, who further notes that, "These circumstances, together with the fact that a large percentage of children are working under avoidable handicaps of bad throats, vision, hearing and teeth would indicate that parents should have their children carefully examined."

✚

Minnesota.—Special research in the effect of tuberculosis on vital lung capacity is to be conducted at the University of Minnesota by Dr. J. A. Myers, instructor in medicine at that university, as the result of his appointment to the fellowship of the Hennepin County (Minnesota) Tuberculosis Association. This fellowship was established by the Association in the Graduate

School of the University of Minnesota for original research in the cure and prevention of tuberculosis.

The practical application of Dr. Myers' study will be with reference to the earlier detection of tuberculosis and the determination of how much and what kind of work a patient, in whom the disease has been arrested, can do without risking a relapse. He has already published results of earlier researches into the effect of tuberculosis on vital lung capacity, as well as studies on the mammary gland, the voice organ, and the nervous system.

✚

Mississippi.—The State Bureau of Rural Sanitation is operating in eight counties at present. Union and Calhoun counties each recently made an appropriation of $5,000 for a health unit. The State Board of Health, in coöperation with the International Health Board, will contribute to each of these counties an equal amount, making a budget of $10,000 per county. Each health unit is in charge of a trained and competent health official who is a physician. The program of county health work is upon a broad basis, devoting special attention to the control of soil pollution diseases and child welfare, including medical inspection of school children.

The State Board of Health is considering the question of manufacturing anti-rabic material for the people of the state. It is believed that it can be manufactured by the Board cheaper than it can be purchased. Heretofore this treatment has been obtained free from the U. S. Public Health Service, and since the supply has been discontinued it is deemed necessary to make the new arrangement.

The work of the Bureau of Child Welfare in Mississippi is becoming well organized under the direction of Dr. F. J. Underwood. Child Welfare Units have been organized in as many as five counties. The work consists in pre-natal work, care of expectant mothers, medical examination of all the school children in the county worked, holding nutrition clinics, and considerable attention will be given to children of pre-school age. It is felt that much benefit will come to the people of the state through the activities of this Bureau.

New Jersey.—Some of the legends of the New Jersey Council of Child Welfare, issued in connection with Child Welfare Week (May 8-15, 1921), are worth while noting for use of other communities engaged in similar work. "Come, let us build a happy state!" is the first suggestion followed by the question, "Is your community ready to do its share?" while others impress important principles, as may be seen by running them over:

"Let us give every New Jersey baby a chance to be born well."

"As he grows older, let us make New Jersey mean to him opportunity and generous help."

"Let us make New Jersey mean home."

"If we do this, we shall not need to worry about Bolshevism, or any other 'ism' that destroys."

"Let us give every child in the state a chance for a strong, healthy body, and happy play days to remember."

"Let us build the happy, contented New Jersey of tomorrow by the right care for the children of today."

✚

New Mexico.—Five full-time county health units are now in operation in the state, under the direction of trained health officers. They are as follows:

Union county, Dr. C. H. Douthirt, Clayton; San Miguel county, Dr. M. D. Moran, Las Vegas; Santa Fe county, Dr. D. B. Wilson, Santa Fe; Bernalillo county, Dr. J. F. Docherty, Albuquerque; and Chaves county, Dr. D. W. Gudakunst, Roswell.

Under the law recently passed, it is planned to appoint a sub-registrar of vital statistics in each school district in the state. These men will receive payment at the rate of 25 cents each for every birth and death certificate filed by them. It is hoped that this will improve materially the collection of vital statistics.

On April 28th there was held in Albuquerque a conference of all local health officers in the state. Demonstrations were given at the State Public Health Laboratory and the operation of the full-time county health department was shown. This is the first conference of its kind to be held in New Mexico and it was planned to form, at that time, the New Mexico Health Officials' Association. The conference was held on the day preceding

the meeting of the State Medical Society in the same city.

The free venereal clinic in Santa Fe has been growing rapidly, due to the activities of the full-time health officer and of Miss Adelaide Arms, Field Agent of the Interdepartmental Social Hygiene Board. During February and March all of the prostitutes in the city were rounded up and were found to be infected with one or more venereal diseases in every case. They were placed in isolation by an order of the District Court and were given treatment at the clinic. A free venereal clinic is being established in Albuquerque under the direction of the full-time health officer.

Following the reorganization of the Department of Health as the Bureau of Public Health of the State Department of Public Welfare, the salary of the Director of the Bureau, formerly the Commissioner of Health, has been increased from $3,000 to $4,000.

✣

North Carolina.—Nearly 300 people in North Carolina met their death last year by fire, the total being barely below the record for the previous year. In 1920 there were 18 lives lost in conflagrations, while 279 died from other burns. The total was 297. For 1919 there were 24 lives lost in conflagrations, and 276 from other burns. The total was 301, just four more than for the last year.

The majority of the deaths from burns were children, resulting from the accidental catching fire of their clothing either from open fires or playing with matches. In the list of those dying from conflagrations are also children who had been left in houses that caught on fire and who could not escape.

The death rate for nearly every disease is being steadily reduced, according to the statistics of the Board of Health, but the accident hazard, as the figures for deaths by burning show, remain practically unchanged.

A new low rate for deaths from tuberculosis in North Carolina was established in 1920 according to statistics just compiled by the State Board of Health. The total number of deaths from this cause for the past year was 2,865, as against a total of 3,005 for the previous year. The reduction in deaths from tuberculosis was one of the important items in enabling the state to achieve a remarkably low death rate as a whole, the rate for all diseases having been 12.9 per thousand.

In the nation tuberculosis is chargeable with slightly more than 10% of all the deaths that occur. In this state it causes approximately 8% of all deaths. In other words, one out of every 12 deaths in the state is from this cause.

Fatalities from tuberculosis have been much greater among the colored people of the state than among the white. During the past two years a special educational effort against this disease has been made among the colored people by the extension department of the state sanatorium and the State Tuberculosis Association. The recent General Assembly made an appropriation of $100,000 for a sanatorium for Negroes, and health authorities feel confident that equally good results can be obtained in the reduction of deaths from this cause among the Negroes as have been attained for the population as a whole.

✣

Ohio.—Forty-four Ohio counties, exactly one-half of the counties in the state, have full-time health commissioners today as a result of the Hughes-Griswold act, which went into effect January 1, 1920. The accompanying map shows these forty-four counties in black.

The situation this year represents a substantial increase in health service over that of last year, the first year of operation under the new law.

A great increase in public health nursing service has also resulted from the Hughes-Griswold law. The law makes it optional whether a health commissioner shall be employed for whole or part-time service. Cities, which under the Ohio law are municipalities with more than 5,000 population, constitute separate health districts from the counties in which they are located. In practice, however, full-time health service for the county has in several cases been obtained by an arrangement whereby the city and the surrounding county employ the same man as health commissioner, with his time so divided that the two positions virtually constitute one whole-time position.

For the courtesy of the use of the map showing the distribution of counties having full-time health officers, the JOURNAL is in-

debted to Ohio State Department of Health.

In coöperation with the Ohio State Sanatorium the State Department of Health and the Ohio State Medical Association, the State Association has been assisting in developing a series of county tuberculosis clinics. The results have more than met expectations. The demands were so great that all future plans have had to be held in abeyance until additional personnel can be secured to carry on the work. An appropriation from the legislature will probably be available on July 1st with which to carry the work forward.

A health pageant, "Forward for America," suitable for use by school children, has been prepared under the auspices of the Ohio Public Health Association, and was given its first performance on April 8 in Memorial Hall, Columbus, O. During the summer months it is the intention to present the pageant in connection with the county fairs of the state.

Preparation of an outline course for teaching hygiene in the schools has been practically completed by Miss Virginia Lewis, director of Modern Health Crusade. The course is graded and covers the entire eight grades of the public school system. The superintendent of public instruction is coöperating in the work of establishing this course.

✣

Oklahoma.—The Oklahoma Public Health Association, which is a live force for good health in the state, has issued an ambitious program. It announces for the foundation fact that its principles are the prevention of

tuberculosis and the betterment of health in general among the citizens. Its slogan is, "Help your neighbor—protect yourself." Its agencies are set down as tuberculosis sanatoria, public health nursing, health education, baby welfare work, health crusade in the schools, Negro health activities and health surveys.

The Association is efficiently organized for the practical accomplishment of necessary work and can effect this with economy. With a field that is state-wide it does much of its work in collaboration with local and county organizations.

✣

Texas.—Dr. J. D. Blevins of Beaumont has been appointed Director of the Bureau of Communicable Diseases of the State Health Department and Dr. S. M. Ramsay has been named for Food Inspector for the Northwestern District of the state.

Last year anti-malaria work was carried on in about a dozen towns of the state and already this season there are indications that the number will be more than doubled this year.

The State Health Department has undertaken a piece of educational work in the preparation of an extensive exhibit which was shown in Dallas during the Texas Congress of Mothers and Parent-Teachers Associations, in April and at the meeting of the State Medical Association in May.

A questionnaire has been sent to all physicians in the state requesting statistics on the prevalence of cancer during the year just passed, and a similar enquiry has been addressed to all county and city health officers with reference to the prevalence of leprosy, pellagra, and encephalitis lethargica during the year 1920.

✣

Utah.—In its current issue of its monthly Health Letters the Department of Public Instruction is conducting a catechism on cancer. This takes up the important facts with reference to the disease, that it can be cured if taken in time, that advertised cures are to be avoided, since the fact is that there is no known medicine that will cure the disease, that irritations predispose to cancer, etc., together with an outlining of conditions that should lead the individual to consult a physician.

The same Department, which is active in the all-important matter of public health education, sends to its schools each month carefully prepared outlines for hygienic studies. The last talk, that for the ninth month, is a review of the general subject of care for one's own health.

✣

Virginia.—There is quite a bit of rivalry between Richmond and Charlottesville for the honor of being the site for the proposed medical school which is to be made of the two units now conducted separately at the two places. The result of this is that the health conditions in the two places are being very closely evaluated. Everyone knows of the excellent quality of health administration in Richmond, while at the same time, the public spirit of Albemarle County, in which Charlottesville is located, is admirable. It will be interesting to see the outcome of the matter.

Virginia's text book, "Home Nursing," a bulletin recently issued by the State Board of Health and reproduced in book form, has proved invaluable to the Ontario division of the Canadian Red Cross. This week, when re-ordering copies for all his nurses, the director of the division highly complimented the health board of the American state.

The text book which is being used in the high schools of Virginia and primarily intended as a class book is nevertheless equally serviceable for professional nurses, keeping them mindful of details that are sometimes overlooked; and it is a little book that might well be in every home. Its appearance is attractive; its language is simple.

✣

Saskatchewan.—The Soldiers' Settlement Board has recently conducted short course for soldiers' wives in rural centres, at which the Bureau of Public Health has had charge of all the medical and nursing work undertaken. Baby clinics were held at which soldiers' babies were examined. The women themselves were examined and in cases of illness, arrangements were made for free treatment. In connection with the educative course, lectures and demonstrations were given on home nursing, first aid, and moving pictures and lectures given on venereal disease and general subjects.

At the present time plans are under way

for the enlarging of exhibits to be shown at fairs during the summer months, in showy material consisting of numerous posters and useful models, which have been made specially to suit the requirements of the rural districts, of which the province is largely composed.

In connection with the fairs baby clinics are also conducted, at which large numbers of children are medically examined and scored.

A new Children's Pavilion has recently been added to the Provincial Sanatorium for the care of tuberculosis cases. This pavilion has been built by funds collected by the Provincial Order of the Daughters of the Empire and furnished by the local chapters, and is already taking care of a large number of small patients.

INDUSTRIAL HYGIENE AND OCCUPATIONAL DISEASE

Abstracted by DRS. E. R. HAYHURST and E. B. STARR.

Chronic Carbon Monoxide Poisoning—Its Immediate and Subsequent Manifestations.—This paper presents the clinical observations made by a physician upon herself and three patients who were exposed to small quantities of carbon monoxide gas over a period of two months, during which the presence of carbon monoxide was not suspected as a cause of the symptoms and covering a second period of two months, during which the cause of the trouble was recognized but had not been brought under control. In the course of a third period, extending from January to December, 1920, certain symptoms representing hypersensitization to minute quantities of carbon monoxide were noted. The unique feature of the paper is the careful clinical data describing the symptoms and signs presented by the three patients and the subjective symptoms experienced by the author.

During the first period the symptoms described are—tingling, contracting sensations in the fingers and toes; spontaneous twitching of one finger or toe; numbness of face and scalp, with sensation of a tight-fitting cap on the head; chest walls seem heavy and difficult to move, with breathing an effort; sensation of weight and impeded heart action; sudden transient pallor; dark red lower lip; red patches over bones in which minute veins are sharply marked; color of lower lip and patch on cheeks is in sharp contrast to pallor of face; eyeball has a peculiar "shiny" or "glittering" appearance; veins of hands are strikingly narrow and dark, almost black; acute central abdominal cramps with visible muscular spasms; pain in bladder, difficulty in starting urination; transient "fainting spells"; shivering attacks without temperature; nervous irritability and depression; "raw" throat.

During the second period great fatigability; shortness of breath on exertion, with rapid pulse; extreme chilliness, hands cold and lifeless; impossible to get warm even in front of a roaring fire; sudden uncontrollable drowsiness; extreme thirst; transient bronzing of skin; a peculiar transient "shrinking" of face which looks pinched and old, this sign continuing at times for many hours; "uncomfortable" headache; irregular "flatting" pulse.

During the third period marked hypersensitization to minute amounts of carbon monoxide as when coming into proximity to exhaust gas from automobile or smoke from chimneys—the symptoms being sudden, acute, transient nausea; numbness of feet extending to knees; numbness of face and scalp, the latter feeling too tight; headache was characteristic and circumscribed to a small area of scalp which became sore to touch and not relieved by usual remedies; headache does not incapacitate for work, though is highly unpleasant and wears off in a day or so.

The author calls attention to certain precautions which every physician should be prepared to take in cases that are poisoned by carbon monoxide. The author also calls attention to the manner in which the gas clings to inanimate objects and also to the possible relation existing between endocrine efficiency and

chronic carbon monoxide poisoning. Any one interested in this subject would do well to read the original article.—Georgine Luden, *Modern Medicine*, Vol. 3, Nos. 2 and 3, pp. 102 and 167, 1921.—(*E. B. S.*)

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Industrial Lead Poisoning.—This paper was awarded the Hamilton Fisk Biggar, Sr., prize for 1920, granted by the Cleveland Medical Library Association. It is presented for the purpose of clearing up a few points of disagreement in relation to lead poisoning and is based upon a study of 900 workers exposed to lead hazards in American industries. Eighty cases of lead poisoning were diagnosed and 95 other cases were tentatively diagnosed as lead poisoning. The author points out that there are now approximately 200 American industries in which lead in some form is used. The author states that poisoning may occur from fumes or molten lead even when the temperature does not reach the boiling point. He has demonstrated by means of sodium sulphide papers that lead fumes are given off from pots of molten lead at a temperature of 730° F., and has found cases of lead poisoning among men working with lead at this temperature. In acute cases the red blood cells become more resistant to hemolysis than normally and Liebermann's blood corpuscle resistance test is of diagnostic value. Acute plumbism is usually diagnosed by symptoms rather than signs. In the chronic form of poisoning marked pallor is almost a constant symptom. Contrary to the usual opinion the author is inclined to believe that this pallor is due to spasm of the arterioles rather than to an actual anemia and a number of cases of chronic poisoning are cited to prove his contention. In the author's studies he has also found basophilic degeneration of the red cells to occur far less frequently than other investigators have observed and he concludes that this finding has been greatly overrated as a diagnostic sign. The author observed one change in the blood picture which is practically constant in chronic cases, namely, a marked increase in the large mononuclear cells, ranging from 10 to 35%. Hayhurst is the only other investigator the author refers to as having noted a similar finding. Interstitial neuritis, which affects usually the nerves supplying the muscle groups which are most used, is described by the author as probably the most important pathologic change in chronic lead poisoning, while headache is the most common symptom presented by the nervous system. The author refers to the lead line as merely indicating potential lead poisoning although it was demonstrable in 90% of his positive cases. Hypertension of the blood vessels is not so common as generally supposed and was only found in one group of workers in a lead refinery. The paper presents illustrations of typical lead palsies. Constipation as a symptom of chronic lead poisoning is not so common in the author's opinion as is usually thought. Under the head of diagnosis he points out the fallacy of refusing to make a diagnosis in the absence of lead line, colic or wrist drop. Sulphur baths and the Oliver-Clague electrolytic treatments are referred to as of problematic value. No comment is made as to the value of a daily dose of 1 grain of calcium sulphide as used in some factories.

The measure of first importance in curative treatment consists in removal of patient from sources of poisoning. Potassium iodine should not be used in acute cases and when given in chronic cases, should be in small initial doses on account of the danger of too sudden liberation of lead which is likely to lead to reabsorption accompanied by an exacerbation. Magnesium sulphate is probably the best aid in the treatment of constipation by formation of a relatively insoluble sulphide of lead in the intestines. Benzyl benzoate has the promise of becoming the sovereign remedy in the treatment of constipation and colic. For the paralysis, massage and the galvanic current are of value. As an aid to the prophylactic and the curative treatment of industrial plumbism, the author points out the necessity of providing for the compensation of occupational disease. By this means there would be a great reduction in the number of permanent disabilities and early treatment would be encouraged, which is just as important in lead intoxication as in the successful treatment of tuberculosis. Real progress cannot be hoped for unless physicians recognize it as their duty to report all cases of occupational disease to state departments of health, thereby revealing the true prevalence of these diseases. The effects of lead poisoning should be looked for in morbidity records rather than in mortality records. The action of lead is to cut short the normal span of life.

Lastly, the author sets forth certain "Principles of Prognosis" which he formulates as follows:

1. Cases of lead poisoning in which patients continue to be exposed to lead, under con-

stant conditions, intoxication steadily progresses.

2. Patients who continue to be exposed to the hazard, but who observe proper hygienic precautions, usually tend to improve and many such recover.

3. Patients with lead poisoning who continue to be potentially exposed in factories where working conditions are improved, usually tend to improve and many recover.

4. Patients with lead poisoning who remove themselves from the source of danger usually recover, with the exception of the severe and long continued cases.—Martin D. Shie, *Jour. A. M. A.*, March 26, 1921, pp. 835-842.—(*E. B. S.*)

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The Application of Certain Physical Efficiency Tests. — It is the purpose of this article to state applications of Schneider's physical efficiency test in the Medical Division of the Air Service. By this scoring method it is attempted to determine the degree of "staleness" or physical inefficiency. "A physician skilled in neuropsychiatry and cardiovascular work can make a diagnosis of staleness, but he cannot determine the degree of fatigue." "Schneider, by use of arbitrary numbers, has made the best effort in this direction." The author has also tried Crampton's method of scoring physical efficiency. In Schneider's test which was used on 410 cases the mean score was found to be 11, the maximum possible score being 18. By the Schneider method those making a score of 8 or more will be qualified and those with a score of 7 or less disqualified. The Schneider method of scoring is based on the combined evaluation of the following six factors, each factor having a maximum value of three—(1) Reclining pulse rate. (2) Standing pulse rate. (3) Pulse rate following exercise. (4) The promptness with which pulse returns to normal after exercise. (5) Systolic blood pressure in standing position. The arbitrary method of scoring may be found in a table appearing in an article by Schneider, Jour. *A. M. A.*, May 29, 1920. The degree of physical disability produced by loss of sleep, acute infections, dissipation and various excesses is numerically shown by the scoring test. The article also sets forth the value of daily systematic exercise as determined by physical efficiency tests. In summary it is stated that "Schneider's test does not supplant, but should be used in conjunction with a thorough physical examination. For use with aviators and athletes this is the best test so far offered for measuring physical efficiency and fatigue. The physical directors of schools and colleges will find this test a valuable aid in determining the amount of exercise necessary for physical fitness in each individual case." The writer believes that a man who can only make a score of nine should be given a thorough physical examination to determine whether his condition is due to disease or to insufficient exercise. The writer has encountered two conditions in which any test based on cardiovascular efficiency will not reveal the true condition of a man; these are (a) bradycardia, which gives a better rating than the condition warrants and (b) those who are disturbed psychically, who would receive a lower rating than they deserve. Before qualifying or disqualifying an aviator it is best to make scoring tests on three successive days.—Verner T. Scott, M. C., Air Service, Mitchel Field, L. I., N. Y. *Jour. A. M. A.*, Vol. 76, No. 11, March 12, 1921, p. 705.—(*E. B. S.*)

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A Study of Pulmonary Silicosis. — The clinical aspects of the problem of silicosis are dealt with in this article based on a study of 57 cases. The condition depends upon the inhalation of dust containing a considerable amount of free silica in finely divided particles most of them being less than 2 microns in diameter, particles so fine that it is difficult to find a respirator capable of arresting them without embarrassing the breathing of the wearer. The gross and microscopic character of uncomplicated silicotic lung is minutely described, as well as that of the silicotic lung infected with tuberculosis. The patient's statement as to the time of onset of symptoms is often misleading in view of the fact that patients generally assign the beginning of illness to the time of some intercurrent condition which in fact marks an exacerbation of the insidious condition. The period of exposure to silica dust necessary to produce symptoms varies greatly. One of the author's cases had been exposed but six weeks to the dust. Another patient showed very definite symptoms and signs two years after the commencement of a period of nine months' work involving exposure. The onset of symptoms may immediately follow exposure or appear a variable time after exposure has ceased. The average time elapsing between commencement of ex-

posure and onset of symptoms was about 19 years.

Dyspnea was the early symptom observed in many of the cases. The insidious onset of this symptom is such that patients overlook its presence until some intercurrent catarrh exaggerates the symptom. It is present in some degree in every established case and in the absence of complications is a guide to the degree of fibrosis present. Next in frequency to dyspnea is cough, which becomes quite troublesome during attacks of influenza or colds. Other symptoms which may be present are occasional hemoptysis which proved fatal in two cases, pleuritic pains, night sweats, weakness and wasting. It is possible by a physical examination to obtain the first indications of the presence of the condition even before the patient is cognizant of anything abnormal. Routine physical examinations of workmen in dusty trades is, therefore, valuable in the early discovery of these cases.

Where tuberculosis complicates the condition, bronchial or amphoric breath sounds can be heard. The commonest site for early signs is to be found in the writer's experience in the right mammary region. Radiography proves a valuable aid to diagnosis of silicosis. The author presents typical cases representing early stage, middle stage and advanced stage cases.

From the standpoint of prognosis, "So long as the condition remains one of uncomplicated silicosis, progress is virtually dependent on the increase of dyspnea." Intercurrent catarrhs increase the dyspnea and may become chronic. From the onset of symptoms till time of death, the period of illness varies greatly. Among stone masons, the average was 6¼ years, among lead miners 3¾ years, among silica workers 3¾ years, in quarrymen 2½ years. The most important variation in course of disease was produced by the intercurrence of tuberculosis which, when advanced, can not be differentiated from ordinary chronic tuberculosis. The length of illness in the presence of tuberculosis is shortened. The removal of the patient from the source of irritation does not arrest the progress of the disease, as the fibrotic process continues. Silicosis predisposes to tuberculosis as a result of changes produced in the lungs, though the condition may produce death without the presence of tuberculosis, in which case death often results from pneumonia, influenza, or failure of the heart, following on the respiratory embarrassment.

Prophylaxis is the only means of combating the disease which may be effected by preventing generation of dust at its source and in the early exclusion of workers showing signs of shortness of breath. Special measures should be taken in industries involving exposure to dust of high silica content.—E. L. Middleton, *Jour of Indus. Hyg.*, Vol. II, No. 11, March, 1921, p. 433.—(*E. B. S.*)

Take Notice! The Fiftieth Annual Meeting of the A. P. H. A. will be held in New York City, November 14-18, 1921. Headquarters at Hotel Astor.

PUBLIC HEALTH LABORATORY NOTES

Abstracted by ARTHUR LEDERER, M. D.

Experimental Studies of the Nasopharyngeal Secretions From Influenza Patients.—An active transmissible agent present in the nasopharynx in early cases of influenza has been found to produce definite and characteristic clinical reactions and pathological effects in rabbits as already described in an earlier publication. The experiments here reported indicate that this active agent has the following properties. The agent as it exists in the nasopharyngeal secretions in man, and in the lungs of rabbits injected with the human secretions, passes through Berkefeld V and N candles. The filtered material produces the same effects on the circulating blood and on the lungs of rabbits as the unfiltered material. The peculiar effects described as arising in the inoculated rabbit may also be induced in guinea pigs inoculated with the agent. The agent responsible for the reaction on the blood and the lungs of rabbits withstands the action of glycerol in a sterile 50% solution, for periods up to nine months. The question must be left open at present whether the agent can withstand longer contact with the chemical. In two experiments after 10½ months' contact the agent induced no observable changes in the blood and lungs of rabbits. The influenzal agent exerts an effect on the pulmonary tissue which encourages the invasion of the lung and subsequent multiplication there of ordinary bacteria, such as the pneumococcus, streptococcus, and *Bacillus pfeifferi*. A similarity is believed to exist between the conditions under which concurrent infections arose in the inoculated rabbits and those which seem to favor the occurrence of concurrent infections during epidemic influenza in man. In no instance did death occur in the rabbits as a result of the uncomplicated effects of the influenzal agent alone. When death occurred in any of the inoculated animals concurrent infection of the lungs by ordinary bacteria was present. The microorganisms most commonly met with under these conditions were Pneumococcus Type IV and atypical Type II, streptococci, and hemoglobinophilic bacilli. Other kinds encountered less often.—Peter K. Olitsky and Frederick L. Gates, *Jour. Exp. Med.*, 33, 301 (1921).

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Relation of Certain Carrier Conditions to the Virulence of Hemolytic Streptococci.—A low degree of virulence of hemolytic streptococci for mice is found to occur in cultures taken from healthy carriers, as compared with those from cases of actual infection. No differences in virulence have been observed between strains from early and from late carrier states. The duration of a strain in a healthy throat seems to have little to do with its virulence. A rather rapid decrease in virulence seems to occur after the acute infection has ended. Chronic carriers of hemolytic streptococci as a result of an attack of tonsillitis show a very small percentage of virulent strains. A large percentage of cases of acute tonsillitis become chronic carriers of hemolytic streptococci, as evidenced by cultures of tonsils removed three to six months following the acute attack.—Leon C. Havens, and Margaret L. Taylor, *Am. Jour. Hyg.*, 1, 192. (1921.)

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Bacterial Content of Telephones With Special Reference to Respiratory Pathogens.—Various pathogenic bacteria are present and can be isolated from the transmitters and receivers of telephones. Hemolytic streptococci were isolated in 15.9%, the diphtheria bacillus in 2%, and the pneumococcus in 1%, from the transmitters and receivers of 94 telephones. 90.0% of 11 strains of hemolytic streptococci isolated were virulent for rabbits. Sterilization of telephones should be practiced to prevent the spread of virulent organisms. Cleansing with soap and warm water and subsequent sterilization in bichloride of mercury, lysol, etc., for a period of 10 minutes, is recommended. In speaking, the mouth should not come in direct contact with the transmitter. The public should be taught how to use the telephone hygienically.—Clarence C. Saelhof, *Am. Jour Hyg.*, 1, 234. (1921.)

Blood Cultures in Bubonic Plague.—The authors examined the blood of 20 patients admitted to the Claude Bernard Hospital with buboes supposed to be due to plague, and obtained the following results: (1) In 8 cases in which the other laboratory tests were simultaneously negative the blood cultures were also sterile. (2) Of 12 cases in which the diagnosis of plague was established bacteriologically, namely, by presence of Yersin's bacillus in the pus or serum of the glands, inoculation into mice and cultures from the glands, the blood cultures remained sterile in 3, and in 9 were positive. The authors, from a study of their cases, came to the following conclusions: (1) The presence of Yersin's bacillus in the blood is the rule during the first days of the disease. (2) The mildest forms may be associated with bacteremia. (3) The bacteremia present in the mild forms of bubonic plague must be distinguished from the primary or secondary plague septicemia which is the rule in grave forms with multiple visceral lesions. Cultivation of the blood is a valuable addition to the bacteriological diagnosis of plague.—Teissier, Tanon, Gastinel and Reilly, *Bull. et Mém. Soc. Méd. des Hôp. de Paris*, February 17, 1921; *Brit. Med Jour.*, No. 3143. (1921.)

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New Method Facilitating Detection of Tubercle Bacilli.—The authors describe a new method of treating sputum, pus, feces, etc., in which it is desired to determine the presence of tubercle bacilli. To the suspected fluid (10 volumes) is added filtered sterilized ox bile (8 volumes), to which two drops of tincture of iodine per cubic centimeter have been added. The mixture is shaken, and becomes completely liquefied after 18 hours at 37° C., three hours at 56° C., fifteen minutes at 100° C. After cooling, one-third the volume of saturated salt solution is added, then 2 or 3 c. cm. of ether. After shaking the mixture is centrifuged (about 6,000 revolutions). By means of a platinum loop fragments are withdrawn from the pellicle which forms at the junction of the watery and ethereal layers. Using this method the authors have found among 73 sputa 23 instances in which a positive result was found in cases which by the ordinary methods appeared negative; tubercle bacilli were found also in 4 cases of cold abscess and 3 of pleuritic effusion.—Grysez and Bernard, *C. R. Soc. Biologie*, December 4, 1920; *Brit. Med. Jour.*, No. 3142. (1921.)

Rate of Sedimentation of the Blood Cells in Tuberculosis.—The author reports favorably on the simple test, the principle of which depends on the fact that the rate at which the blood cells sink in a vertical column of blood is hastened by various diseases, including tuberculosis. He describes in detail the technique of this test, and discusses the results of about 3,000 tests made on 500 persons, 369 of whom were tuberculous. The rate of sedimentation varied greatly in health and disease; it ranged from 1 to 120 mm. per hour; but a rate that exceeded 10 mm. per hour was invariably associated with some pathological condition. The author found this test of little diagnostic value because in pregnancy and in a host of diseases other than tuberculosis the rate of sedimentation is affected. On the other hand, he found it of great value in gauging the degree of activity of the tuberculosis, for the rate of sedimentation varied directly with the activity of the disease, as determined by injections of tuberculin. The test was more delicate than the measurement of the temperature as an index to the degree of activity of the disease; in some cases the rate of sedimentation began to rise some time before a rise of temperature was demonstrable by the thermometer. The author suggests that this test may indicate a condition which he describes as "fever without rise of temperature." The test was not only of great prognostic importance, but also a valuable guide to the effect on the course of the disease—Westergren, *Acta Medica Scandinavica*, January 26, 1921; *Brit. Med. Jour.*, No. 3142. (1921.)

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Number of Red Blood Corpuscles at Different Ages and Under Different Conditions.—The author fixes the averages at 5.5 millions in men and 5 millions in women. The upper limit is 6.1 millions in men below 30, slightly lower in women. Above 60 the numbers are nearly normal in both sexes, some cases showing figures even higher than normal. This may be due to deficient cardiac power, but alcoholism also accounts for it. Of greater importance is the fact that the number of erythrocytes varies in different parts of the blood vessels and can vary greatly in the different capillaries. The physiologic condition of the extremities thus must be taken into account in clinical counts.—H. I. Bing, *Acta Medica Scandinavica, Stockholm*, 53, 833 (1921).

Experiments on the Carriage of Intestinal Protozoa of Man by Flies.—Free forms of *Entaæba histolytica* and *Chilomastix mesnili* ingested by flies were killed in an hour or less, not encysting. Motile *Chilomastix* were observed in a fly's feces 7 minutes after it had fed on a stool containing them. Cysts of the intestinal protozoa ingested by flies were gradually killed in times varying with the species. When flies which had ingested cysts were drowned in water, the cysts survived much longer. In experiments designed to test the maximum capacity of flies at a single meal, it was found that a single housefly (*Musca domestica*) could ingest 0.0068 c.c. of fluid and a single blow fly (*Calliphora erythrocephala*) could ingest 0.022 cc. An infection with *Herpetomonas muscæ-domesticæ* was found in only one out of 223 specimens of *Musca domestica* examined at Baltimore. Two infections with *Herpetomonas calliphoræ* were found in 124 specimens of *Calliphora erythrocephala* examined.—F. M. Root, *Am. Jour. Hyg.*, 1, 131. (1921.)

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Comparative Study of Hemolytic Streptococci from Milk and from Human Lesions.—The number of cultures used in this work was not great, especially the group of human pathogenic cultures, yet they were carefully selected and are believed to be fairly representative. Several conclusions may, therefore, be warranted from the study of the data presented. Hemolytic streptococci which differ in many respects from human pathogenic streptococci occur quite generally in raw and pasteurized milk. A large number of these strains behaved alike in a series of tests, and they, therefore, seem to form a homogeneous group or species. There are certain general differences in morphology between milk and human hemolytic streptococci. These are not absolute and by themselves are of little value for purposes of differentiation. The reaction of milk hemolytic streptococci in litmus milk is characteristic and is of importance in differentiating them from pathogenic strains. The pathogenic hemolytic streptococci have a greater range of fermenting power than do the milk strains. The most constant difference between the two groups is the failure of the latter to ferment saccharose. The identification of hemolytic streptococci should always be confirmed by testing for hemolysis in broth culture. The true Beta type produces hemolysin in broth, while others which resemble the Beta type quite closely do not. There is no constant difference in the hemolytic titer of milk and pathogenic strains, but the time required for hemolysis to take place is distinctly greater with the milk strains. This characteristic could be used to aid in differentiation. The milk hemolytic streptococci are not pathogenic for mice, and virulence cannot be demonstrated even by successive passages. The difference in the thermal death rates of milk and pathogenic hemolytic streptococci serves to differentiate them. The former die at a slow rate in milk at 60° C., while the latter die rapidly. With a very large number present it is possible for pathogenic streptococci to survive pasteurization at 60° C. for 30 minutes. The number of survivors is undoubtedly very small, but they are able to produce a culture virulent for mice. Higher pasteurizing temperatures would give a better margin of safety. Successive heating of pathogenic streptococci does not result in the production of a heat resistant strain. Hemolytic streptococci resembling the pathogenic type in every respect were isolated from certified milk. They are of low heat resistance and could readily be destroyed by proper pasteurization.—Raymond C. Salter, *Am. Jour. Hyg.*, 1, 154. (1921.)

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Cholesterol in Cerebrospinal Fluid.—Normal cerebrospinal fluid contains no cholesterol or only a very small trace of it. Fuids in which the Wassermann and Lange reactions are positive contains no cholesterol in appreciable amounts. Only three out of 25 such fluids gave a reading in the colorimeter. Fluid of hemorrhage of the brain showed high cholesterol content. Fluid from tumor of the brain gave a trace of cholesterol. Fluid from a case of brain abscess gave a high cholesterol reading. The majority of meningitis fluids showed a trace of cholesterol. Three fluids had a high reading. Ventricular fluid gave no cholesterol reading, except when there was the presence of hemorrhage of the brain or other pathologic condition. The Hauptmann reaction seems to depend on the cholesterol content of the cerebrospinal fluid. This work does not bear out Pighini's contention that the Wassermann reaction depends on the cholesterol of the fluid. The authors believe that the cholesterol content depends wholly or partially on the permeability of the meninges.—A. Levinson, L. L. Landenberger and K. M. Howell, *Am. Jour. Med Sciences*, 161, 561. (1921.)